DEPARTMENT OF THE NAVY
BUREAU OF MEDICINE AND SURGERY
WASHINGTON, D.C. 20372

IN REPLY REFER TO
BUMED-3C222:GIS
6470
Ser: 10714024
14 July 1981

From: Chief, Bureau of Medicine and Surgery
To: All Ships and Stations Having Medical/Dental Personnel

Subj: Radiation Health Protection Manual (NAVMED P-5055); advance change notice to

Encl: (1) Advance Change Notice (ACN) 4 to NAVMED P-5055

1. Purpose. To affect an advance change to NAVMED P-5055.

2. Discussion

a. The following are the major changes to NAVMED P-5055 promulgated by ACN 4:

(1) Radiation medical reexaminations are required every three years. This requirement is independent of radiation exposure received by the individual.

(2) Slit lamp eye examinations are required as a routine part of each preplacement and termination radiation medical examination.

(3) Physical requirements for qualification for occupational exposure to ionizing radiation are stated in greater detail.

(4) Procedures for correcting deficient radiation medical examinations are provided.

(5) The current life-time radiation exposure limit based on (N-18) x 5 rems is deleted.

(6) A strict 5 rems per year limit is implemented.

(7) Type A neutron film is no longer an approved Navy dosimetric device. All commands using type A film for neutron monitoring shall request lithium fluoride thermoluminescent dosimeters in accordance with procedures contained in chapter 6 of enclosure (1). Conversion to lithium fluoride dosimeters shall be completed not later than 31 December 1981.

b. Chapters 2 and 6 in enclosure (1) are complete revisions of the previous chapters. Sections in chapters 3, 4 and 5 of enclosure (1) which contain changes are identified by revision bars.

Subj: Radiation Health Protection Manual (NAVMED P-5055); advance change notice to

c. The following BUMED notices are superceded by ACN 4:

(1) BUMEDNOTE 6470, BUMED-53 dated 19 July 1977, subject: Occupational Radiation Workers with a history of therapeutic irradiation.

(2) BUMEDNOTE 6470, BUMED-532 dated 15 December 1977, subject: Lithium Fluoride Thermoluminescent Dosimeters (LiF TLD); issue period for

(3) BUMEDNOTE 6470, BUMED-3C2 dated 31 October 1979, subject: Radiation medical examinations.

d. Organizations associated with the Naval Nuclear Propulsion Program are exempt from the requirements of Chapters 4, 6 and 7 of NAVMED P-5055. This exemption does not relieve medical department personnel from the responsibility for ensuring proper performance of dosimetry. Medical Department Representatives shall audit the performance of dosimetry according to procedures contained in NAVMED P-5055.

e. Organizations associated with the Naval Nuclear Weapons Radiological Controls Program are exempt from Chapters 4 and 7 of NAVMED P-5055.

f. Organizations associated with the Radiological Affairs Support Program (RASP) are exempt from the requirements of chapter 7 of NAVMED P-5055 as stated in NAVFAC Instruction 5100.15.

g. During the last BUMED reorganization, the Undersea and Radiation Medicine Branch was designated as BUMED Code 3C2. All correspondence submitted to BUMED concerning radiation health matters should be addressed to Code 3C2.

3. Implementation

a. The requirement that a radiation medical examination be performed every three years shall be fully implemented not later than 31 December 1982.

b. All other provisions of enclosure (1) shall be implemented upon receipt.

BUMED-3C222:GIS
6470

Subj: Radiation Health Protection Manual (NAVMED P-5055); advance change notice to

4. Action

a. Remove chapters 2 through 6 of the current manual and insert chapters 2 through 6 of enclosure (1).

b. Replace pages iii through v, A-1, A-2, A-7 and A-8 with corresponding pages in enclosure (1).

c. Add pages A-9, A-10, A-11, A-12, A-13 and A-14 from enclosure (1).

d. Replace appendix B (page B-1) with new appendix B (Thermoluminescent Dosimetry Audit Procedure) from enclosure (1).

e. Delete pages vi, vii, and appendices C, D and E.

f. Page check the manual using the list of effective pages contained in enclosure (1).

5. Cancellation. When the required action has been completed and the change entered in the record of changes.

H. A. SPARKS
Acting

List of Effective Pages

	Pages	
Table of Contents	iv through v	(ACN-4)
Chapter 1	1-1 through 1-4	(original)
Chapter 2	2-1 through 2-29	(ACN-4)
Chapter 3	3-1 through 3-3	(ACN-4)
Chapter 4	4-1 through 4-6	(ACN-4)
Chapter 5	5-1 through 5-12	(ACN-4)
Chapter 6	6-1 through 6-17	(ACN-4)
Chapter 7	7-1 through 7-3	(original)
Appendix A	A-1, A-2	(ACN-4)
	A-3, A-4, A-5, A-6	(original)
	A-7, A-8, A-9, A-10, A-11, A-12, A-13, A-14	(ACN-4)
Appendix B	B-1 through B-3	(ACN-4)

CONTENTS

Chapter 5. EXPOSURE RECORDS

Chapter 6. PERSONNEL DOSIMETRY

Chapter 7. STORAGE, HANDLING AND DISPOSAL

Appendix A SAMPLE FORMS

Appendix B THERMOLUMINESCENT DOSIMETRY AUDIT PROCEDURE.....B-1

Chapter 2

RADIATION MEDICAL EXAMINATIONS

2-1. BACKGROUND

(1) Personnel occupational radiation exposure criteria are based upon the concept that there may be some degree of risk from any level of radiation exposure, although medical knowledge shows the risk from radiation exposure within limits to be small. Consequently, radiation protection standards for individuals who are to be occupationally exposed differ from those for individuals regarded as members of the population at large. Because of this difference, occupationally exposed personnel receive medical examinations to establish baseline results and to evaluate diseases which may medically disqualify a person from receiving occupational radiation exposure. This difference in standards is justified on the basis of:

(a) The radiation worker accepting some small degree of risk which is balanced against benefits, based upon competent technical appraisal.

(b) A deliberate selection of candiates for work involving exposure to ionizing radiation.

(2) The following excerpts are included to provide medical personnel with a more detailed understanding of the risks of exposure to ionizing radiation. In 1977, Publication 26 of the International Commission on Radiological Protection became available. This report concentrated its risk estimates on cancers of various types, because for other than cancer,"there is not good evidence of impairment of function of organs and tissues

at the levels of dose normally encountered in radiation work. The evidence for life-shortening from effects other than tumour induction is inconclusive and cannot be used quantitatively. Moreover, it seems unlikely that any major hazard from irradiation at recommended levels has been overlooked, as judged by the evidence from heavily irradiated populations observed for periods up to 30 years."

The United Nations Scientific Committee on the Effects of Atomic Radiation made a similar statement in a report which became available in 1977: "There is increasing evidence that in human beings.... the induction of malignancies (cancer) represents the most important effect produced at low doses in the exposed individual...."

The following statements concerning cancer induction are quoted from the most recent publication of the findings of the National Academy of Sciences Committee on the Biological Effects of Ionizing Radiations (BEIR-1980):

o "Cancers induced by radiation are indistinguishable from those occurring naturally; hence their existence can be inferred only on the basis of a statistical excess above the natural incidence."

o "Cancer may be induced by radiation in nearly all the tissues of the human body."

o "Tissues and organs vary considerably in their sensitivity to the induction of cancer by radiation."

o "The natural incidence of cancer varies over several orders of magnitude, depending on the type and site of origin of the neoplasm, age, sex, and other factors."

o "With respect to excess risk of cancer from whole-body exposure to radiation, solid tumors are now known to be of greater numerical significance than leukemia. Solid cancers characteristically have long latent periods; they seldom appear before 10 yr after radiation exposure and may continue to appear for 30 yr or more after radiation exposure. In contrast, the excess risk of leukemia appears within a few years after radiation exposure and largely disappears within 30 yr after exposure."

o "The major sites of solid cancers induced by whole-body radiation are the breast in women, the thyroid, the lung, and some digestive organs."

o "The incidence of radiation-induced human breast and thyroid cancer is such that the total cancer risk is greater for women than for men. Breast cancer occurs almost exclusively in women, and absolute-risk estimates for thyroid-cancer induction by radiation are higher for women than for men (as is the case

with the natural incidence). With respect to other cancers, the radiation risks in the two sexes are approximately equal."

o "There is now considerable evidence from human studies that age is a major factor in the risk of cancer from exposure to ionizing radiation. Both age at exposure and age at cancer diagnosis are important for interpretation of human data. If risks are given in absolute form--i.e. numbers of cancers induced per unit of population and per unit of radiation exposure--then a single value independent of age may be inappropriate. The 1972 BEIR report concluded that the risk of some kinds of cancer was greater after irradiation in childhood and in utero than in adult life. It is now apparent that other age groups may also have risks that differ from the average for all ages; e.g., women exposed during the second decade of life have the highest risk of radiation-induced breast cancer."

o "Various host or environmental factors may interact with radiation to affect cancer incidence in different tissues. These may include hormonal influences, immunologic status, exposure to various oncogenic agents, and nonspecific stimuli to cell proliferation in tissues sensitive to cancer induction by radiation."

o "The time elapsing between irradiation and the appearance of a detectable neoplasm is characteristically long, i.e., years or even decades. This long latent period must be taken into consideration in all risk calculations, whether these are estimates of the risk experienced by populations under study or projections into the future."

o "The variety of possible biologic mechanisms responsible for human cancer suggests that the dose-response relationship may not be the same for all types of radiation-induced cancer. The fact, however, that epidemiologic studies of widely differing human populations exposed to radiation have given reasonably concordant results for some cancer sites and for a broad range of radiation dose adds considerable strength to the dose-response information now available."

o "Some of the existing human and animal data on radiation-induced cancers are derived from populations exposed to internally deposited radionuclides for which dose-incidence relationships are influenced by marked nonuniformities in the temporal and spatial distribution of radiation within the body."

o "Some of the human data concern cancer mortality; others, cancer incidence. It is appropriate to distinguish radiation-induced cancers that may not greatly alter the death rate (e.g., skin and thyroid cancer) from others that are generally fatal (e.g., leukemia and lung cancer)."

o "It is not yet possible to estimate precisely the risk of cancer induction by low-dose radiation, because the degree of risk is so low that it cannot be observed directly and there

is great uncertainty as to the dose-response function most appropriate for extrapolating in the low-dose region."

The fact that all the above reports have similar estimates of risk should not be surprising since these organizations evaluated the same information from long-term studies of humans exposed to radiation. The organizations used data primarily from humans for their numerical risk estimates. The organizations caution that their risk estimates may overestimate the actual risk for low radiation exposures. The risk estimates from the reports can be briefly summarized as follows:

In a large population group (such as 100,000 people ages 20-65) receiving an annual total of 10,000 man-rems year after year, the increased risk from this radiation appears to be in the region of about one fatal cancer case each year and about one leukemia case every five years in excess of the normal numbers of cases.

To help put this risk estimate in perspective, comparisons are needed. For example, the June 1979 report of the President's Interagency Task Force on the Health Effects of Ionizing Radiation stated that in a typical group of 10,000 people in the U.S., a total of 1600 will die of cancer . If each of the 10,000 received over his lifetime one rem more than he was already receiving from background and medical sources, then according to the preceding risk estimate one additional person would die of cancer. Therefore, the 1600 cancer deaths would increase to 1601 for this group of 10,000 people.

Even though the actual risk is probably lower than this estimate, the risk estimate is low compared to risks normally accepted in industrial work.

(3) No radiation injuries have been documented in man under exposure conditions which were compatible with existing radiation protection guides. Nonetheless it is imperative to document fully and take advantage of the best available biomedical and other scientific specialists whenever a situation arises in which personnel injury or illness may be associated with exposure to radiation. In the past, responsible medical department personnel have made statements or signed certificates which indicated a causal relationship between radiation exposures and physical defects that could not be substantiated by existing facts or documents. This has led to unwarranted public and employee concern and apprehension. Merely including radiation exposure information in association with personnel injury or illness may be misconstrued by a patient or the public as indicating a causal relationship. The resulting public apprehension could seriously jeopardize the military and civilian nuclear power programs. Therefore, in all illness or injuries allegedly associated with radiation, the significance of any radiation exposure shall be carefully evaluated and documented.

2-2. TYPES OF RADIATION MEDICAL EXAMINATIONS

(1) Preplacement Examinations (PE). All personnel who are being considered for routine assignment to duties or occupations requiring exposure to ionizing radiation or the handling of radioactive materials shall be given a medical examination prior to assignment or transfer to those duties or occupations. This requirement exists independent of anticipated annual radiation exposure. This examination shall be performed to ensure that a prospective worker is medically qualified for occupational exposure to ionizing radiation. Personnel who are not routinely exposed to ionizing radiation as a result of their normal duties or occupation and who are not likely to exceed 0.5 rem per year (e.g., visitors, including messengers, servicemen, deliverymen, and certain crewmembers or employees whose exposure is truly sporadic) are not required to have preplacement medical examinations. (See implementing radiological controls manuals for specific programs.) If an individual in this category (i.e., not required to have a preplacement radiation medical examination) exceeds 0.5 rem exposure in a calender year, then he shall have a preplacement radiation medical examination within one month of the time he exceeds 0.5 rem in a calendar year or as soon thereafter as operational requirements permit.

(2) Reexamination (RE). Personnel who are to be continued in routine duties or occupations requiring exposure to ionizing radiation or the handling of radioactive material shall have a reexamination at least every 3 years. The reexamination may be performed earlier than 3 years for the purpose of even distribution of medical examination work load or to combine the reexamination with a medical examination required for another purpose. The reexamination is required to be performed no later than one month following the 3 year anniversary date of the previous radiation medical examination or medical examination accepted and documented as a radiation medical examination. When constrained by ship operating schedules, the examination is to be performed at the earliest opportunity.

(3) Situational Examinations (SE). A situational medical examination shall be given to any individual who has exceeded the radiation protection standards for occupational exposure as stated in Chapter 4 of this manual, or has ingested or inhaled a quantity of radioactive material exceeding 50 percent of a maximum permissible body burden (MPBB) or as deemed necessary by the cognizant medical officer. (Maximum permissible body burdens are listed in National Council on Radiation Protection and Measurements (NCRP) Report No. 22 (NBS Handbook 69).)

(4) Termination Examinations (TE). All persons who have received a preplacement radiation medical examination and have documented radiation exposure (including 00.000 rem) shall be given a radiation medical examination upon separation or termination of their employment, or when permanently removed from the radiation health program. All reasonable efforts shall be made

to ensure that a worker receives his termination medical examination. If a termination medical examination is not completed or not performed due to lack of employee cooperation, etc., a form SF-78 or SF-88 shall be prepared and completed to the maximum extent practicable. The reasons why the form is incomplete shall be recorded in block 73 of form SF-88 or in block 3, Part B of form SF-78.

(5) Other Medical Examinations. Medical examinations (those other than radiation medical examinations) and results of consultations for individuals qualified for routine assignment to duties or occupations requiring exposure to ionizing radiation or the handling of radioactive materials shall be reviewed by the medical department representative for findings or evaluations affecting continued qualification for such duties. Medical examinations performed outside the Department of Defense are not to be requested for routine review. The scope of other medical examinations need not be expanded to cover the requirements of this manual unless the examination is to be used as a radiation medical examination.

2-3. COMMAND RESPONSIBILITY

(1) The Commanding Officer or Officer in Charge of a naval facility shall insure that personnel have a radiation medical examination prior to being occupationally exposed to ionizing radiation or handling radioactive material.

(2) If it is known that a visitor is to perform duties requiring a radiation medical examination, the visitor's parent command shall determine the visitor's medical qualifications for occupational exposure to ionizing radiation.

2-4. THE RADIATION MEDICAL EXAMINATION

(1) The radiation medical examination (PE, RE, SE, TE) shall include, but not be limited to, a careful history, complete and thorough physical examination, complete blood count, urinalysis and other clinical laboratory studies or procedures, bioassays, and slit lamp examinations as indicated or required. In addition, the scope of the radiation medical examination shall meet the requirements of MANMED or FEDPERMAN as appropriate. If a medical examination has been conducted within the previous twelve months for a purpose other than occupational exposure to ionizing radiation and has been duly recorded in the individual's Health Record or Industrial Health Jacket, it may, at the discretion of the cognizant medical officer, be accepted in part or in full in lieu of corresponding sections of the radiation medical examination (See Article 2-8.) A medical examination conducted for one purpose is valid for any other purpose within the prescribed period if it is of the proper scope specified. If the examination is deficient in scope, only those tests and procedures needed to meet the additional requirements need be accomplished. If a previous medical examination is accepted by the cognizant medical officer, the date of the required

reexamination is 3 years from the date of the accepted medical examination.

(2) Medical History

(a) For all radiation medical examinations, a complete medical history on a SF-93 shall be obtained in accordance with the appropriate sections of MANMED Chapter 15 or FEDPERMAN Chapter 339. In addition to these requirements, medical histories for all naval personnel and civilian employees receiving radiation medical examinations shall specifically include:

(1) History of occupational exposure to ionizing radiation;

(2) History of cancer or precancerous lesions;

(3) History of anemia;

(4) History of cataracts;

(5) History of radiation therapy;

(6) History of radiopharmaceuticals received for therapeutic purposes;

(7) History of work involving the handling of unsealed radium sources.

(8) Family history of malignancies (e.g. leukemia), anemia, and cataracts.

(b) For situational examinations, the medical history shall contain summary statements which provide the basis for performing the examination.

(3) Physical Examination. The physical examination shall be conducted in accordance with MANMED Chapter 15 or FEDPERMAN Chapter 339 and FEDPERMAN Supplement 339-31, as applicable. The examiner conducting the "hands on" physical examination shall place particular emphasis on determining the existence of malignant and premalignant lesions, lenticular opacities, and other conditions which could be related to radiation exposure.

(4) Laboratory and Other Procedures. The following studies shall be performed as follows:

(a) Chest roentgenogram (X-ray). Not required unless there is clinical justification at the time of the medical examination, or unless it is required by another type of medical examination being performed concurrently.

(b) Complete blood count (CBC). Required on all radiation medical examinations. A CBC shall consist of hematocrit (hemoglobin may be performed in lieu of hematocrit), total white blood cell count, and white blood cell differential count.

(c) Urinalysis. A routine urinalysis, including microscopic examination, is required on all radiation medical examinations. When deemed necessary by the cognizant medical officer, a radiochemical urinalysis will be performed. There is no requirement to document the non-performance of a radiochemical urinalysis. If radiochemical urinalysis cannot be accomplished within the local command, urine samples shall be collected and shipped to the appropriate medical support facility in accordance with the instructions contained in Chapter 3 of this manual.

(d) Slit Lamp Examination

(1) Background. "A causal involvement of radiation-induced damage of epithelial cells in the germinative zone of the lens in radiation cataractogenesis has not yet been proven. However, the available evidence from animal studies strongly suggests this mechanism, on the basis of the differentiation of the affected cells into abnormal lens fibers and the time coincidence between the appearance of lens opacification and the rate of migration of lens epithelial cells into the posterior lens cortex. Accumulation of aberrant cells in the posterior cortex causes alteration in the lens cytoarchitecture resulting in a loss of transparency. There is no direct evidence that lens opacification depends on the killing of epithelial cells in the germinative zone. The sigmoid cataract dose-response curves and the protective effect of partial lens shielding provide evidence that other factors are involved in radiation cataractogenesis in addition to cell-killing.

The available data suggest a sigmoid dose-response relationship with an apparent threshold for lens opacification. Threshold doses in man for x-rays and gamma rays delivered in a single exposure vary from 200 to 500 rads, whereas the threshold for doses fractionated over periods of months is around 1,000 rads. Continuing observations of lens changes in survivors of Hiroshima and Nagaski have been reported. The subjective nature of the lens assay techinques used by the several investigators involved in these studies, as well as the limited dose information, precludes a quantitative assessment of dose response or of the relative effects of fission neutrons and gamma radiation on cataract induction in humans. These data are, however, consistent with a sigmoid dose-response relationship in the dose range from 20 to 450 rads, with a dose threshold of about 200 rads or greater for the induction of vision-impairing lens opacification. The latent period for cataract induction has been estimated to be some 10 months after exposure. A comparison of cataract incidence for all periods of observation with the incidence in the sample group followed for 25 years after exposure suggests the possibility of an interaction of radiation cataractogenesis with age, although the statistical significance of the difference in

incidence cannot be established, owing to the above-mentioned limitations of the sample data." (Note: Background quoted from: The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, Report of the Committee on the Biological Effects of Ionizing Radiation, Division of Medical Sciences, Assembly of Life Sciences, National Research Council, National Academy of Sciences, 1980): In order to put the above scientific information into perspective, the following statement is provided: Radiation induced cataracts may only be expected in some personnel as a result of an accident situation in which radiation exposure received was several orders of magnitude above the occupational radiation exposure received by the average radiation worker in his lifetime.

(2) Purpose. Slit lamp examinations are conducted on designated military and civilian personnel in the Naval establishment to screen, detect, and record the earliest signs of lenticular opacities and to record preexisting or congenital lesions.

(3) Frequency. A slit lamp examination shall be conducted as a routine part of each preplacement and termination radiation medical examination. Slit lamp examinations performed within the previous twelve months may be utilized. Additionally, slit lamp examinations shall be conducted following identification of lens opacities by ophthalmoscopic or other techniques of examining the undilated eye. Other slit lamp examinations may be performed as directed by the cognizant medical officer. If the quarterly or annual whole-body radiation exposure limits have been exceeded, a slit lamp examination shall be conducted within 30 days of determining that the limit was exceeded.

(4) Procedure. Slit lamp examinations shall be conducted by an ophthalmologist, optometrist, or medical officer experienced in the use of the slit lamp. The slit lamp examination shall be made with the eyes widely dilated with mydriatrics and/or cycloplegics, preferably Neosynephrine (phenylephrine) 2.5 percent, or Mydriacyl (tropicamide) 0.5 to 1 percent. The intraocular pressure and the angle of the anterior chamber shall be measured prior to the instillation of mydriatics and/or cycloplegics. Individuals with increased intraocular pressure and/or shallow anterior chamber shall be deferred until evaluated by an ophthalmologist. The results of the completed slit lamp examination shall be fully described. (See sample SF 513, slit lamp overprint.)

(e) Special Examinations. Special examinations shall be performed when deemed necessary by the cognizant medical officer or radiation health officer except as specifically required below. Additional requirements to perform special examinations due to specific work environments are to be promulgated in program radiological control manuals with CHBUMED concurrence.

(1) Radon Breath Analysis. All personnel assigned to duties involving the handling of radium, or its compounds, not

hermetically sealed shall have radon breath analysis at the beginning and end of such assignment and following personnel contamination incidents involving loose surface contamination of radium compounds. Chapter 3 provides information on the method of obtaining radon breath analysis support. Other techniques of determining internal radium deposition may be utilized with CHBUMED's prior written approval.

(2) Internal Monitoring (external counting). Internal monitoring is the technique of choice to identify and quantitate internally deposited gamma emitting radionuclides. Radiation detectors used for this purpose may be of varied design, counting geometry, sensitivity and energy resolution. However, the minimum detectable activity (at 2 standard deviations of background) shall be less than ten-percent of the body or organ burden for the radionuclide being examined. (See Chapter 3).

(3) Bioassay. In addition to radon breath analysis and internal monitoring, other bioassay techniques for the determination of radioactivity in body tissues, secretions, and excretions may be appropriate. When deemed necessary by the cognizant medical authority of a ship, unit, or command which lacks the capability to perform appropriate bioassays, a request shall be submitted to a designated support facility (See Chapter 3).

2-5 INDIVIDUAL RESPONSIBILITIES. All personnel assigned to duties involving potential occupational exposure to ionizing radiation shall report the following in a timely manner:

(1) Radiation therapy received;

(2) Radiopharmaceuticals recieved for diagnosis or treatment;

(3) Occupational radiation exposure from secondary or temporary employment;

(4) Open wounds or lesions (See article 2-5(3)).

2-6 PHYSICAL REQUIREMENTS

(1) General. The general physical requirements are those for active duty in the military service or in civil service employment as defined in MANMED or FEDPERMAN, as appropriate.

(2) Medical History. Any medical history of occupational radiation exposure in excess of that allowed by current directives, medical history of radiation therapy or a history of a medical condition which may be associated with exposure to ionizing radiation shall be carefully reviewed by a medical officer with knowledge of the potential biological effects of ionizing radiation. Medical history of a systemic malignancy, history of radiation therapy which may have compromised bone marrow reserves, and polycythemia vera shall be considered disqualifying. The history of an actinic keratosis, adequately treated, is not considered disqualifying. Medical history of

skin cancer other than adequately treated basal cell skin cancer shall be considered disqualifying. Family history of cancer which is suggestive of clustering or genetic tendency toward a specific lesion shall be considered disqualifying.

(3) Physical Examination. The presence of disease states or abnormalities which may be associated with exposure to ionizing radiation shall receive careful review by a medical officer knowledgeable of the potential biological effects of ionizing radiation. Physical findings of a cancerous or precancerous lesion (e.g. actinic keratosis) shall be considered disqualifying. An individual who has an open lesion or wound (including lacerations, abrasions and ulcerative, eruptive or exfoliative lesions) is prohibited from handling radioative material which is not hermetically sealed until such time as the medical department representative considers that the wound is sufficiently healed or considers the wound to be adequately protected from radioactive contamination.

(4) Laboratory Procedures.

(a) Complete blood count. Any deviation from the values in Table I shall be evaluated by a medical officer and a determination made concerning qualification. The cognizant medical officer shall comment in item 73, SF-88, or in the "Conclusions" section on the SF-78, when the values of CBC are not within the guidelines of Table 1. If either the hematocrit or hemoglobin are within the guidelines of Table I, a comment concerning hematocrit or hemoglobin is not required.

Table 1

Blood Constituents	Male	Female
Hematocrit	40-52%	37-47%
Hemoglobin	14-18%	12-16%
White Blood Count (per cubic mm)	4,000-12,000	4,000-12,000
Differential Count		
Neutrophiles	40-80%	40-80 %
Lymphocytes	20-50%	20-50%
Bands	0-10%	0-10%
Eosinophiles	0-10%	0-10%
Basophiles	0-3%	0-3%
Monocytes	0-10%	0-10%

The medical officer's evaluation of the CBC and his requests for other studies or consultations shall be directed toward the determination of malignant or premalignant conditions and hematopoietic system reserve. The following conditions shall be disqualifying without further evaluation being required:

Hematocrit - less than 35% or greater than 56%

Hemoglobin - less than 11% or greater than 19%

White Blood Count - less than 3,500 or greater than 14,000

Further evaluation of the above findings may be appropriate for the purpose of medical diagnosis and treatment. Individuals disqualified based upon the above requirements may be reevaluated at a later date at the discretion of the cognizant medical officer.

(b) Urinalysis. Red blood cells in urine persisting on repeat urinalysis is disqualifying pending definitive determination as other than a malignant condition. Other abnormal urinalysis results may be of clinical signficance (e.g. low specific gravity, positive sugar or albumin, WBCs or casts) dictating follow-up evaluation at the discretion of the examining medical officer; however, they are not in themselves disqualifying for occupational exposure to ionizing radiation.

(5) Lenticular Opacities. Disqualifying lenticular opacities are confined to those involving the posterior subcapular and/or posterior polar regions of the lens of the eye.

(a) The following are specifically NOT DISQUALIFYING unless such as to preclude adequate examination of the posterior portion of the lens:

(1) Opacities of the anterior capsule, anterior subcapsule, cortex, nucleus, or posterior capsule.

(2) Y Suture

(3) Mittendorf Dot

(4) Hyaloid Artery Remnant

(b) The following, even through located in the posterior subcapsular and/or posterior polar region of the lens (each eye being treated separately), are NOT DISQUALIFYING:

(1) Vacuoles which are single and discrete, up to four in number, and without evidence of grouping or clustering.

(2) A single minute punctate opacity.

(c) All other opacities involving the posterior subcapsular and/or posterior polar region of the lens are to be considered disqualifying.

(6) Special Examinations

(a) If as a result of bioassay, internal monitoring or other techniques it is determined that an individual has in

excess of 10 percent, but less than 50 percent of a maximum permissible body burden (MPBB) of radioactive material(s) (not intentionally administered for medical diagnosis or treatment) he may be considered qualified for duties involving occupational radiation exposure pending BUMED review. If an individual exceeds 50 percent MPBB he shall be disqualified from duties involving occupational radiation exposure pending BUMED review. (Maximum permissible body burdens are listed in NCRP Report No. 22 (NBS Handbook 69).)

(b) Radon Breath Analysis. The presence of more than 0.5 picocuries of radon per liter of expired air is considered disqualifying.

2-7. RECORDS/DOCUMENTATION

(1) Medical examinations and laboratory studies shall be recorded on SF-88 for military personnel and SF-78 for civilian personnel.

(2) Records of examinations performed by physician assistants or nurse practitioners must be reviewed and counter-signed in block 79 or 80 of the SF-88 or the conclusion section of the SF-78 by a medical officer.

(3) All radiation medical examinations require a medical officer's/physician's signature in block 82 of the SF-88 or in the conclusion section of the SF-78. This medical officer/physician is responsible for reviewing the complete medical examination including laboratory and other information to determine qualification for occupational exposure to ionizing radiation. Reviewing medical officer/physician may be the same as the examining medical officer/physician.

(4) Medical history shall be recorded on SF-93. The use of an overprint or rubber stamp on a SF-93 for required supplementary history is acceptable (See sample SF-93).

(5) For block 74 (SF-88) or block C.4. (SF-78) and block 25 (SF-93), each entry concerning an abnormal finding shall have an indication of CD (considered disqualifying) or NCD (not considered disqualifying) after each entry.

(6) Addendum SF-78, SF-88, and SF-93 forms may be used as appropriate.

(7) Results of special examinations and formal consultations shall be recorded on SF-513.

(a) Slit lamp examinations shall be documented on the SF-513. (See sample SF-513, slit lamp overprint.)

(b) All consultative reports from specialists in hematology, nuclear medicine, oncology, radiology, etc. shall be recorded on SF-513. The results of bioassay, internal monitoring,

etc., which document monitoring for internally deposited radioactivity, shall be recorded and reported as required in Chapter 5.

(8) Non-completion of radiation medical examinations shall be documented with specific reasons. The basis for non-compliance with radiation medical examination requirements is to be documented in the medical record in block 73 of the SF-88 or in block 3, Part B, of the SF-78.

(9) Radiation medical examinations including those required to be submitted to BUMED, shall clearly state whether the individual is qualified or disqualified for occupational exposure to ionizing radiation.

(10) No radiation medical examination report or portion thereof shall be removed from an individual's health record.

(11) Radiation medical examinations recorded on other forms prior to the promulgation of this change need not be transcribed.

(12) The fact that a termination medical examination is required shall be entered on the front of the individual's health record jacket as "Termination radiation medical examination required in accordance with NAVMED P-5055."

2-8. PROCEDURES FOR CORRECTING DEFICIENT RADIATION MEDICAL EXAMINATION/ACCEPTING OTHER MEDICAL EXAMINATION FINDINGS (SF-88 AND SF-93)

(1) Procedures for SF-88:

(a) If the purpose of the medical examination, block 5 of SF-88, is "Occupational Exposure to Ionizing Radiation" and the medical examination is deficient, the deficiency is to be corrected by appropriate entries in block 73 of SF-88. Entries in block 73 shall include date, examining facility, significant interval history, additional information to correct deficiency, statement of PQ/NPQ and medical officer's signature. If there is inadequate space in block 73, an Addendum SF-88 shall be prepared. The following entry shall be made at the top front page of the Addendum SF-88: "Addendum to medical examination dated _____". Blocks 1-17, 77-82, and appropriate blocks for information being added shall be completed on the Addendum SF-88. Other blocks on the Addendum SF-88 may be left blank. The purpose of examination, block 5, i.e. (PE), (RE), (SE) (TE) is to be the same on the Addendum SF-88 as the SF-88 being corrected. The Addendum SF-88 is to be placed in the health record immediately following the SF-88 to which the Addendum applies.

(b) If the purpose of a medical examination, block 5 of SF-88 is other than occupational exposure to ionizing radiation and the medical examination is less than one year old deficiencies in the medical examination or deficiencies in its scope for a radiation medical examination shall be corrected as described

in (a) above. The type of radiation medical examination, i.e. occupational exposure to ionizing radiation (PE), (RE) (SE) or (TE) shall also be entered in block 73 of SF-88 (in addition to other information required in (a) above), or block 5 Addendum SF-88 as appropriate. If a medical examination performed for a purpose other than occupational exposure to ionizing radiation is over 1 year old, it can not be used as a radiation medical examination.

(c) The number of attached sheets, if any, to the original SF-88 shall be indicated in the space provided opposite block 82.

(2) Procedures for SF-93:

(a) If the purpose, block 5, of SF-93 is occupational exposure to ionizing radiation, and the SF-93 is deficient, the deficiency shall be corrected by completing an Addendum SF-93. The following entry shall be made on the top front page of the Addendum SF-93: "Addendum to medical history dated _____". Blocks 1-7, individual's signature and date, typed or printed name of physician or examiner, date and physician signature, and appropriate blocks for the required information to correct the deficiency shall be completed on the Addendum SF-93. Other blocks on the Addendum SF-93 may be left blank. The purpose, block 5, i.e. (PE), (RE) (SE) or (TE) is to be the same on the Addendum SF-93 as the SF-93 being corrected. The Addendum SF-93 is to be placed in the health record immediately following the original SF-93. The number of attached pages to the original SF-93 should be indicated in the space provided on lower right back of the original $F-93.

(b) If the purpose of the report of medical history SF-93 is other than occupational exposure to ionizing radiation, an Addendum SF-93 with the proper purpose and appropriate type of radiation medical examination, i.e. (PE), (RE) (SE), (TE) shall be completed. The Addendum SF-93 shall be completed in its entirety. The following entry shall be made at the top front page of the Addendum SF-93: "Addendum to medical history dated (_____)". The Addendum SF-93 shall be filed immediately following the original SF-93. The number of attached pages to the original SF-93 should be indicated in the space provided on the lower right back of the original SF-93.

(3) Deficient radiation medical examinations dated prior to 1 January 1979 shall not be corrected. Deficient radiation medical examinations dated after 1 January 1979 shall be corrected in accordance with the procedures above.

2-9. MEDICAL RECORDS REQUIRING SUBMISSION TO BUMED

(1) The following findings on a medical history or medical examination shall be submitted to BUMED, Code 3C2.

(a) History of occupational radiation exposure or internal deposition in excess of that allowed by this manual.

(b) History of radiation therapy.

(c) If as a result of a bioassay, internal monitoring, or other techniques, it is determined that an individual has in excess of 10 percent of a maximum permissible body burden (MPBB) of radioactive material (not intentionally administered for medical diagnosis or treatment), a report of the findings, including a description of the analysis technique, shall be forwarded to BUMED. (Maximum permissible body burdens are listed in NCRP Report No. 22 (NBS Handbook 69).)

(d) Results of medical examinations for which the requirements are not explicit under sections 2-6(2), (3), (4) (5) and (6).

(e) Any medical examination or condition which the cognizant medical officer/commanding officer recommends BUMED review.

(f) All situational radiation medical examinations.

(2) Copies of all radiation medical examinations which disqualify an individual from receiving occupational exposure to ionizing radiation shall be submitted to BUMED, Code 3C2, for review.

(3) No other radiation medical examination need be submitted.

2-10. IMPLEMENTATION

(1) Medical examinations and health record procedures performed prior to the implementation of this change shall conform to the standards prescribed at the time of the examinations.

(2) Model entries are provided as examples only. Other entries are acceptable provided they conform to the requirements of the Manual of the Medical Department and Chapter 339 of the Federal Personnel Manual.

(3) Questions concerning the performance or documentation of radiation medical examinations, which are not explicitly covered in this manual, may be referred to BUMED, Code 3C2.

2-11 SAMPLE INSTRUCTIONS FOR COMPLETION OF SF-88, SF-93, and SF-78

(1) Sample Instructions for Completion of SF-88--
See MANMED and previous articles of this chapter for specific requirements. The examples given below are acceptable by current directives. Other entries are acceptable if in accordance with requirements of MANMED.

	Explanation	Model Entry
Item 1	Last Name-First Name-Middle Name. The names should be recorded in full without abbreviation. If the individual's first or middle name consists only of an initial, each initial should be enclosed with quotation marks. Designations such as "JR" or "II" should appear after the middle name or initial. See MANMED.	BUSH, May BUSH, "R" DOE, John James JR
Item 2	Grade and Component or Position. Use official abbreviation of current rank or rate, branch of service, class and status; i.e., regular or reserve. See MANMED.	EN1(DV), USN
Item 3	Identification No. Enter the social security number. See MANMED.	206-26-7687
Item 4	Home address. Enter the current home address as reported in the personnel record. See MANMED.	802 Canterbury Rd. North Highlands, CA 59405
Item 5	Purpose of Examination. Enter purpose in regard to occupational exposure to ionizing radiation. Abbreviations in capital letters to indicate type of radiation medical examination should be entered in parentheses. Preplacement Examination (PE). Reexamination (RE). Situational Examination (SE). Termination Examination (TE). Secondary purpose may be entered here or in Item 16. See Article 2-2.	Occupational Exposure to Ionizing Radiation (PE)
Item 6	Date of Examination. Actual date of physical examination of individual. See MANMED.	15 JAN 78 15 January 1978
Item 7	Sex. Spell out; do not abbreviate. See MANMED.	Male, Female

Item 8	Race. Entries should be confined to one of the following five classifications: (1) Caucasian. (Puerto Rican (White), recorded as Caucasian) (2) Negroid. (Puerto Rican (Negro), record as Negroid) (3) Mongolian. (Chinese, Japanese, Korean, and Eskimo, recorded as Mongolian) (4) Indian (American) (5) Malayan (Filipino, Samoan, Chamorro, and Hawaiian, recorded as Malayan) See MANMED.	Caucasian
Item 9	Total years Government Service. In "Military" block enter the time (expressed in years and months) served in any branch of the U.S. military services, to include both active and inactive service; i.e., USAF 3y 3m, USA 3y 3m, USN & USNR 3y 3m. The "Civilian" block will normally be left blank unless the military member has had prior Federal Service as a civilian employee. See MANMED.	USN 11y 10m
Item 10	Agency. Leave blank for military personnel. See MANMED.	
Item 11	Organization Unit. List name and Unit Identification Code (UIC) of ship or station to which examinee is attached. See MANMED.	USS PATRICK HENRY (SSBN-599)(BLUE) UIC: 30095
Item 12	Date of Birth. Enter day, month, and year. See MANMED.	1 JAN 50
Item 13	Place of Birth. Enter city, town, or village; and state. If rural, the name of the county may be used. For foreign born, enter the name of country as known at the time of the individual's birth. See MANMED.	Manheim, PA Lancaster County, PA Manheim, Germany Argyll, Scotland

Item 14	Name, relationship, and address of next of kin. See MANMED.	Myrtle Stoltfuss (mother) Ring Road Bump, Alaska 99999
Item 15	Examining Facility or Examiner, and Address. Enter official title and location of the activity or office at which the examination was conducted. See MANMED.	Naval Submarine Medical Center, Groton, CT 06340
Item 16	Other information. Religion may be shown in this block as "P" for Protestant, "C" for Catholic, or "H" for Hebrew. The specific denomination of any of these religions (e.g., Baptist, Lutheran, Methodist, Presbyterian), is not required, unless requested by the individual. The religion of persons belonging to other religious faiths may be recorded. If a person does not desire to state his religious preference the space will be left blank. Secondary purpose for performing the medical examination may also be entered. See MANMED.	"C"
Item 17	Rating or Specialty. Use only for designated aviation personnel and for qualified submarine and diving personnel. See MANMED.	Qualified Diver 1st class
Items 18-43	Clinical Evaluation. Check each item in appropriate column. Enter "NE" for any items not evaluated. The medical examiner shall describe each abnormality in the space designated "Notes" on the face of the form; if additional space is required, continue in item 73. Specific items of importance in regard to exposure to ionizing radiation are to be elaborated upon. See MANMED and Article 2-6.	
Items 18-21	Head and Neck area. Special attention should be given to adenopathy and evidence of	Multiple rubbery nodes posterior triangle, right

	radiotherapy to the area. See MANMED and Article 2-6.	cervical area. consultation requested.
Items 24-27	Eyes and Ophthalmoscopic. Special attention should be given to the presence of opacities in cornea, lens and chambers. See MANMED and Article 2-6.	Lenticular opacity, OS. Slit lamp examination performed. See SF 513 dated _____.
Item 28	Lungs and chest (including breasts). Special attention should be given to the presence of breast masses. See MANMED and Article 2-6.	Discrete nodule, lower outer quadrant, right breast. Surgical consultation requested.
Item 31	Abdomen and Viscera. Special attention should be given to the presence of liver or spleen enlargement and the presence of masses. See MANMED and Article 2-6.	Spleen tip palpable at costal margin. Hematology consultation requested.
Item 33	Endocrine System. Special attention should be given to thyroid masses. See MANMED and Article 2-6.	Discrete nodule, right lower pole, thyroid. Endocrinology consultation requested.
Item 34	Genitourinary System. Special attention should be given to congenital abnormalities, scrotal masses, and cervical (uterine) lesions. See MANMED and Article 2-6.	Undescended testis, right. Urological consultation requested. Cervical erosion, mass at external OS. PAP smear taken Gynecology consultation requested.
Item 39-40	Identifying Body Marks, Scars Tatoos. Skin, Lymphatics. Special attention should be given to congenital abnormalities, skin tumors, burn scars, atrophy, and pigmentation/ depigmentation. See MANMED and Article 2-6.	Severe acne, face, and back. Many open lesions. Dermatology consultation requested.
Items 41-42	Neurologic and Psychiatric. Special attention should be	Verbalization of dysocial attitudes.

	given to congenital abnormalities, personality and character disorders. See MANMED and Article 2-6.	Psychiatric consultation requested.
Item 44	Dental. If a dental officer is not available, the examinee's dental qualifications may be determined by the medical officer and entered under "Remarks" of item 44 with the statement, "Examination not performed by dental officer." See MANMED.	Class I
Item 45-50	Laboratory Findings. Report of laboratory tests or other examinations required incident to a physical examination. Continue in item 73 if necessary. See MANMED and Article 2-6.	
Item 45	Urinalysis. Follow-up evaluation may be done at the discretion of the examining physician. See MANMED and Article 2-6.	Persistent hematuria. Urological consultation requested.
Item 46	Chest X-ray. Enter "NE" if not performed. Enter results of chest examination if an x-ray was performed as a result of clinical justification. See MANMED and Article 2-6.	15 JAN 80 NRMC, Orlando, Fl. Film #: 001234567 Results: WNL
Item 47	Serology. Enter results.	RPR nonreactive
Item 48	EKG. WNL if normal. Enter "NE" if not performed. See MANMED.	EKG: WNL 15 JAN 78
Item 49	Blood type and Rh factor. Enter results or "NE" if not perform.	A Pos
Item 50	Other tests. Baseline and repeat hemograms should be recorded. If any comment is required it may be recorded in block 73, SF 88. The abbreviations below are recommended. WBC-White Blood Count, HCT-Hematocrit, HGB-Hemoglobin	HCT 48 HGB 16.1 WBC 6600 N 70 L 21 M 2 E 4

	(optional test), N-Neutrophile, L-Lymphocyte, M-Monocyte, E-Eosinophile, B-Basophile, BF-Band Forms, juveniles. See MANMED and Article 2-6 and Sample SF 88.	B BF	3 0
Item 51	Height. Record in numerals to nearest inch. See MANMED.	68	
Item 52	Weight. Record in numerals to the nearest pound. See MANMED.	165	
Items 53-56	Self explanatory. See MANMED.		
Items 57-61	Physical Evaluation. To determine the requirement for recording information here, reference should be made to MANMED chapter 15, or to current directives which prescribe the nature and scope of each physical examination and the application of these items to the particular program and rate, rank, or grade involved.		
Item 62, 63, 65, 66, 67, 68, 70, 72	Not routinely required. Leave blank if not performed. See MANMED.		
Item 64	The Farnsworth Lantern Test (FALANT) should be used when color vision testing is required. The pseudoisochromatic plate test should be used only if a Farnsworth Lantern is not available. Color vision should be tested with best corrected vision. See MANMED.	FALANT passed.	
Item 69	Results of intraocular tension. See MANMED.	TOD 16 mm Hg TOS 16 mm Hg	
Item 71	Audiometer. See MANMED		
Item 73	Notes and Significant or Interval History. To be used to record any pertinent medical information or to expand item 50 or other items. See MANMED and Article 2-6.	History of having received 8 millicuries of iodine-131 for thyrotoxicosis in May 1978.	

Item 74	Summary of Defects and Diagnoses. Summarize any defects considered to be of significance. Indicate CD (Considered Disqualifying) or NCD (Not Considered Disqualifying) after each abnormal finding (defect). See MANMED and Article 2-6.	Missing 3rd digit left hand (NCD) Squamous cell skin cancer (CD)
Item 75	Recommendations. Indicate any medical or dental recommendations. Specify any further examination indicated. See MANMED and Article 2-6.	Hematology Consultation requested.
Item 76	Physical Profile. There is no requirement for the physical profiling of Navy and Marine Corps personnel except for the initial physical profiling accomplished at Armed Forces Entrance and Examining Stations (AFEES). See MANMED.	
Item 77	Qualification Line. Show examinee qualified (or not qualified) for the purposes stated in Item 5 and Item 16, as appropriate. Add statement concerning physical qualifications for other duties, if appropriate. See MANMED.	Occupational exposure to ionizing radiation and to perform all duties of his rate/rank at sea and in the field.
Item 78	Disqualifying Defects. Indicate item number only. See MANMED.	
Item 79, 80	Name of Physician, Signature. Enter printed or typed name and signature of physician, physician's assistant or nurse practitioner who actually performed examination. If a physician assistant or nurse practitioner performed the examination, a counter signature by a physician or medical officer is required in block 79 or 80. See MANMED.	LT G.T. Sea, MC, USNR
Item 81	Name of Physician or Dentist, Signature. See MANMED.	LT I. M. Able, DC, USNR

Item 82	Name of Reviewing Officer or Approving Authority, Signature. Enter name of medical officer/ physician responsible for reviewing the complete medical examination including laboratory results and other information to determine qualification for occupational exposure to ionizing radiation. See MANMED and Article 2-7.	LT G.T. Sea, MC, USNR

(2) Sample Instructions for Completion of SF-93--
See MANMED and previous articles of this chapter for specific requirements. The examples given below are acceptable by current directives. Other entries are acceptable if in accordance with requirements of MANMED.

	Explanation	Model Entry
Item 1	Last Name-First Name-Middle Name. The names should be recorded in full without abbreviation. If the individual's first or middle name consists only of an initial, each initial should be enclosed with quotation marks. Designations such as "JR" or "II" should appear after the middle name or initial. See MANMED.	DOE, John James, JR BUSH, May BUSH, "R" SMITH, John Roger
Item 2	Identification No. Enter the social security number. For civilians, the pay/shop number may also be included in parentheses. See MANMED.	247-25-1006 (332-35106)
Item 3	Home address. Enter the current home address as recorded in the personnel record. See MANMED.	802 Canterbury Road North Highlands, CA 59405
Item 4	Grade and Component or Position. Use official abbreviation of current rank or rate, branch of service, class, and status; i.e., regular or reserve. For civilian personnel use the job title and grade. See MANMED.	EN1, USN, or LT, MSC, USN or Nuclear Engineering Technician, GS-9.
Item 5	Purpose of Examination. Enter purpose in regard to occupational exposure to ionizing	Occupational Exposure to Ionizing Radiation (TE). Reenlistment.

	radiation. Abbreviations in capital letters to indicate type of examination for occupational exposure should be entered in parentheses. Preplacement Examination (PE). Reexamination (RE). Situational Examination (SE). Termination Examination (TE). List other purpose(s). See MANMED and Article 2-6.	Preemployment.
Item 6	Date of Examination. Actual date of physical examination. See MANMED.	15 JAN 78 15 January 1978
Item 7	Examining Facility or Examiner, and Address. Record official title and location of the activity or office at which the examination was conducted. See MANMED.	Shipyard Branch Clinic, Naval Regional Medical Center Charleston, S.C. 29408
Item 8	Current health and medications used. See MANMED.	Good health. No. medications
Items 9-24	Self explanatory.- See MANMED.	
Item 11	Questions regarding individual and family medical history should be completed in this section. See Article 2-6, Sample SF-93, and MANMED.	
Item 25	Physician's Summary. Shall be prepared and signed by the person performing the physical examination. Indicate (CD) considered disqualifying or (NCD) not considered disqualifying after each abnormal finding. See MANMED and Article 2-6.	Wears glasses for myopia (NCD) tonsilectomy, 1975 (NCD), allergic to penicillin (NCD). acute lymphocytic leukemia (CD)
Last Line on Reverse side of SF-93	Typed or printed name of physician or examiner; Date; Signature. "Number of Attached Pages" may be left blank if none. See MANMED.	G. T. Sea, LT, MC, USNR

(3) Sample Instructions for Completion of SF-78--
See Federal Personnel Manual and previous articles of this chapter for specific requirements. The examples given below are acceptable by current directives.

	Explanation	Model Entry
Part A.		
Item 1	Last Name-First Name-Middle Name. The names should be recorded in full without abbreviation. If the individual's first or middle name consists only of an initial, each initial should been closed with quotation marks. Designations such as "JR" or "II" may appear after the middle name or initial.	BUSH, May BUSH, "R" BUSH, Ed M. JR SMITH, John Roger
Item 2	Social security account number	247-25-1006
Item 3	Sex. Mark appropriate box.	[X] Male [ ] Female
Item 4	Date of Birth.- Written in the format of 15 JAN 59 or 15 January 1959.	15 JAN 48, 18 December 33
Item 5	The presence of any medical disorder or physical impairment which would interfere in anyway with full performance of duties should be indicated by applicant or employee.	[ ] yes [X] no
Item 6	Signature of individual applicant or employee.	
Part B.		
Item 1	Purpose of Examination. Enter purpose in regard to occupational exposure to ionizing radiation. Abbreviations in capital letters to indicate type of examination for occupational exposure should be entered in parentheses. Preplacement Examination (PE); Reexamination (RE)'s. Situational Examination (SE); Termination Examination (TE). See Article 2-2.	Occupational Exposure to Ionizing Radiation (PE).
Item 2	Enter current position title	Nuclear Engineering Technician

Item 3	Completed only when required by local command. Leave blank if not required.	
Item 4	Applicable functional requirements and occupational factors as determined by local command. Circle requirements only when radiation medical examination is performed in conjunction with preappointment medical examination.	

Part C.

Item 1	Examining physician's typed or printed name.	E. S. Gurley, M.D. examining
Item 2	Examining Facility or Examiner, and Address. Record official title and location of the activity or office at which the examination was conducted.	Shipyard Branch Clinic, Naval Regional Medical Center, Charleston, SC 29408
Item 3	Examining physician's signature and date of examination.	E. S. Gurley 23 May 78

SF-78, Reverse Side

Item 1	Height. Record in feet and inches. Weight. Record in pounds.	6 feet 1 inch 175 pounds
Item 2	Eyes. The SF-78 shall be supplemented with the results of the tonometry and slit lamp examinations. These results may be entered on a supplemental SF-513. See Article 2-6, 2-7 and sample SF 513, slit lamp overprint.	TOD 16 mm Hg TOS 16 mm Hg slit lamp: [x] acceptable [ ] not acceptable [ ] see SF 513
Item 2A	Distant Vision: corrected and uncorrected.	Without glasses right: 20/40; left: 20/100
Item 2B	Near Vision: corrected and uncorrected. It is acceptable to express near vision in Snellen or Jaeger notation or Jaeger No 2. with longest and shortest distance.	Without glasses: R 20/40 or J-4 L 20/50 With glasses R 20/20 or J-1 L 20/20
Item 2C	Color Vision. Farnsworth Lantern Test (FALANT) is	

	desired. The pseudoisochromatic plate test may be used if a Farnsworth Lantern is not available. Color vision should be tested with best corrected vision.	
Item 3	Ears. Audiogram entry may be documented on supplemental SF-513.	
Item 4	Normal findings may be indicated as follows: WNL, N, NEG, or check mark. A brief description shall be provided for any abnormalities as they pertain to each category, respectively.	WNL
Item 4a-4g.	Self-explanatory.	
Item 4h.	Urinalysis. Follow-up evaluation will be done at the discretion of the examining physician. May be documented on Supplemental SF-513.	Sp. gr. 1.021 Sugar Neg; Albumin Neg; Microscopic: WNL
Item 4i.	Respiratory tract. A chest x-ray is not required for a radiation medical examination. Enter the results of chest x-ray examination only if an x-ray was performed as a result of clinical justification or another physical examination requirement. May be documented on Supplemental SF-513.	
Item 4j.	Blood pressure and pulse. Record the results of EKG if performed. The results of the completed blood count may be listed in this block also. CBC results may be documented on supplemental SF-513.	Blood pressure 120/80 Pulse 80 CBC: HCT-48; HGB-16.1;WBC-6600; N-70; L-21; M-2; E-4; B-3; BF-0
Conclusions	(1) It shall be clearly stated whether the individual is qualified or not qualified for occupational exposure to ionizing radiation. (2) Typed or printed name of Reviewing Physician and Date. This space shall always be	Occupational Exposure to Ionizing Radiation ☒ Qualified ☐ Not Qualified

completed to indicate final review of qualification. The same physician may sign here and in block 3, part C. The reviewing physician is responsible for reviewing the complete medical examination including all laboratory data and other information (e.g. results of requested consultations and private medical doctors records and/or opinions) to determine qualification for occupational exposure to ionizing radiation.

Chapter 3

SUPPORT FACILITIES

3-1. SLIT LAMP EXAMINATIONS

(1) Procedure. If a ship, unit, or command lacks facilities to perform such examinations, the required service shall be requested from the nearest naval medical facility or other designated activity which has an examiner qualified to perform these examinations.

3-2. BIOASSAYS

(1) Procedures. When deemed necessary by the cognizant medical officer or radiation health officer of a ship, unit, or command which lacks facilities to perform such analyses, a request for a radiochemical analysis is to be submitted to the USAF Occupational and Environmental Health Laboratory (OEHL/RZA), Brooks AFB, Texas 78235, Autovon: 240-2061; commercial: 512-536-2061. The request shall include a general description of the event or circumstance which produced the possible internal radioactive deposition, the probable radioisotopes present, the results of previous radiochemical urinalysis, and any other pertinent information.

(2) Compliance. When it has been determined that bioassays are needed, the support facility will instruct the requesting activity regarding the collection, preservation, volume and number of specimens required. The support facility will recommend the appropriate shipment procedures to be used, and will supply appropriate containers and preservatives, if necessary.

3-3. INTERNAL MONITORING (EXTERNAL COUNTING)

(1) Procedure. Personnel shall have internal monitoring performed when deemed necessary by the cognizant medical officer or radiation health officer, and as required by program radiological control manuals (see chapter 2). The following organizations are authorized to perform internal monitoring examinations:

(a) Shipyards, tenders, and submarine bases which perform radioactive work associated with Naval nuclear propulsion plants.

(b) Nuclear-powered surface ships and Naval Reactors prototypes.

(c) National Naval Medical Center, Bethesda, Maryland 20814.

(d) Naval Regional Medical Center, San Diego, California 92134.

(e) Other organizations specifically authorized by BUMED.

Naval organizations lacking the capability to perform internal monitoring examinations may request internal monitoring services from the nearest naval organization having the capability and authorization from BUMED to perform internal monitoring.

3-4. RADON BREATH SAMPLES

(1) Procedure. All workroom, storage room, control room, and breath samples shall be collected in flasks, obtained on request, from the USAF Occupational and Environmental Health Laboratory (OEHL/RZA), Brooks AFB, San Antonio, Texas 78235 (Autovon 240-2061; Commercial 512-536-2061). The request for flasks shall specify the number and types of samples to be taken, and shall include the name and telephone number of the individual to contact for shipping information. All flasks shall be returned to the USAF Occupational and Environmental Health Laboratory within a period of approximately 2 weeks after receipt. If, for any reason, a flask has not been used within this period of time, it shall be returned and clearly marked "NOT USED".

(a) Preparation of Flasks. All flasks will be shipped filled with nitrogen. They must be evacuated to approximately 29 inches of Mercury before use.

(b) Control Room Samples. The control room shall be thoroughly ventilated for at least 10 minutes prior to sample collection. Control samples shall be taken prior to the entrance of a breath-sample subject. Entry to the control room shall not be granted to anyone who has entered radium working or storage areas on that day, and only those personnel specifically required for the collection of samples shall be permitted to enter the room until all specimens have been collected.

(c) Breath Samples. Initial breath samples shall be taken before personnel have entered the radium work or storage area. All routine and recheck breath samples shall be obtained on a day following an absence of two full days from the radium workroom or storage areas. Each individual shall remain in the control room at least 10 minutes before his breath sample is collected.

(d) Workroom and Storage Room Samples. Flasks received for workroom and storage room samples will be marked "For Workroom Air Only," and shall not be used for breath or control samples. Samples of workroom and storage room air shall be collected in the same manner as control room samples, except that ventilation shall be the same as that normally supplied during working hours.

(e) Special Samples. Special breath samples to determine possible ingestion or inhalation of excessive amounts of radium can be arranged for by calling the USAF Occupational and Environmental Health Laboratory. (Autovon: 240-2061; commercial: 512-536-2061).

(2) Shipping.

(a) Radon samples must be evaluated within 7 days after collection. Sampling should be planned so that shipments will arrive at the USAF Occupational and Environmental Health Laboratory (OEHL/RZA), Brooks AFB, San Antonio, Texas 78235 before Thursday of each week. All samples shall be forwarded via air mail or other means which will allow evaluation of the sample within 7 days.

(b) Return all sampling flasks in the containers in which they were received, with no additional packing. Further packing of these containers in boxes, crates, or other wrapping will not add to the safety of the flasks during shipment and will frequently delay delivery to destination.

3-5. ASSISTANCE FOR EVALUATION AND TREATMENT OF IRRADIATED OR CONTAMINATED PERSONNEL. Specific guidance for evaluation, monitoring, care and decontamination of personnel is available in BUMED Instruction 6470.10. Advice on the significance of abnormal findings and assistance in the evaluation of personnel suspected of exceeding radiation exposure limits due to external or internal radiation exposure is to be obtained from: BUMED, Code 3C2, telephone, Autovon: 294-4197 or 4224; commercial: 202-254-4197 or 4224; after working hours telephone, Autovon: 294-4348; commercial: 202-254-4348.

Chapter 4

RADIATION PROTECTION STANDARDS

4-1. RESPONSIBILITY

(1) The Commanding Officer or Officer in Charge of any activity which possesses or uses radiation sources is responsible for ensuring that measures are established for controlling ionizing radiation sources such that the radiation exposure to individuals under his command or within his jurisdiction is as low as reasonably achievable and no greater than the limits prescribed herein. He shall acquire appropriate personnel dosimetric devices and require the proper use of such devices. (See Chapter 6.) He shall further ensure for each individual who is occupationally exposed to ionizing radiation, that the amount of radiation exposure received is provided to the custodian of the individual's medical record or to the individual's civilian employer and reported in accordance with Chapter 5.

(2) Anticontamination clothing, masks, and decontamination facilities, as necessary, shall be provided by the command for personnel engaged in handling unsealed radioactive materials. Commands shall maintain an appropriate radiation monitoring capability if there is a potential for radiation exposure levels to exceed those allowed for an unrestricted area, or if airborne radioactivity or loose surface contamination levels exceed the limits specified in Chapter 1.

(3) The following records shall be maintained indefinitely:

(a) Reports of surveys used to evaluate the release of radioactive material to the environment.

(b) Surveys indicating significant contaminating events.

(c) Surveys used to determine estimates of personnel exposure.

Other survey records shall be maintained for at least two years following the date of the survey.

(4) Radiation areas, high radiation areas and contaminated areas shall be posted in accordance with Federal regulations and/or Navy directives.

(5) If an individual travels to a facility at which he will perform duties which require a radiation medical examination (see chapter 2), the individual's parent organization shall determine the individual's medical qualification for occupational exposure to ionizing radiation and shall provide the facility with the individual's current radiation exposure information.

4-2. RADIATION PROTECTION STANDARDS FOR EXTERNAL EXPOSURE

(1) General. Every effort shall be made to maintain personnel radiation exposures as far below Navy radiation protection standards as practicable. Current Navy radiation protection standards are consistent with or more stringent than those of the Environmental Protection Agency, Nuclear Regulatory Commission and the Occupational Health and Safety Administration.

(2) Scope. The standards prescribed herein are adopted for the control of ionizing radiation exposure to personnel within the naval establishment during peacetime and noncombatant operations, and do not include radiation exposure of an individual incident to medical or dental diagnostic and therapeutic procedures to which that individual is or has been subjected. These standards do not apply for emergency situations (see article 4-2(6)), combat operations, or during war.

(3) Radiation Protection Standards for Unrestricted Areas

(a) An unrestricted area is an area to which personnel access is not limited in relation to potential personnel radiation exposure. (See Chapter 1.)

(b) Radioactive material and/or other sources of radiation shall not be used, maintained, or transferred in such a manner as to cause an individual, if continually present in an unrestricted area, to receive a whole body radiation exposure in excess of the following exposure limits:

(1) 2 mrem in any one hour.

(2) 100 mrem in any seven consecutive days.

(3) 500 mrem in a calendar year.

In order to exceed an average level of 500 mrem/year in any unrestricted area it must be locally documented that due to limited occupancy or transient situations, the sum of an individual's whole body exposures from occupancy in all unrestricted areas would not be expected to exceed 500 mrem per calendar year.

(4) Radiation Protection Standards for Occupational Exposures

(a) Whole Body Exposure

(1) Except as provided in paragraph (2) below, radioactive material and/or other sources of radiation shall not be used in such a manner as to cause any indiviudal in a radiation area to receive in any period of one calendar quarter a dose in excess of the limits specified in Table II.

TABLE II

Rem Per Calendar Quarter

1.	Whole body; head and trunk; active blood-forming organs; lens of eyes; or gonads.....	1.250 rems
2.	Hands and forearms; feet and ankles.....	18.750 rems
3.	Skin of whole body.....	7.500 rems

(2) An individual in a radiation area may be permitted to receive a dose to the whole body greater than that permitted in Table II provided:

(a) During any calendar quarter tne dose to the whole body from radioactive material and other sources of radiation does not exceed 3 rems, and

(b) The individual is at least 19 years old, and

(c) The dose to the whole body does not exceed 5 rem for the calendar year. The 5 rems per year limit replaces and is more conservative than the current Federal maximum permissable lifetime exposure limit of 5 (N-18) rems.

(d) Individuals 18 years of age are not permitted to receive a dose to the whole body greater than that given in Table II.

(b) Skin Exposure. In determining compliance with the skin exposure limit of Table II the accumulated radiation exposure to the skin shall include any whole body radiation exposure received during monitoring periods of the calendar quarters in which skin exposures are not separately determined.

(c) Extremity Exposure. In determining compliance with the extremity limit of Table II the accumulated radiation exposure to the extremities shall include any whole body radiation exposure received during the calendar quarter in which extremity exposures are not separately determined.

(5) Underage Personnel. No individual under 18 years of age shall receive in any period of one calendar quarter a dose of ionizing radiation in excess of 10% of the limits specified in Table II.

(6) Emergency Exposure. In an emergency it may be necessary for firefighters or other workers to exceed limits prescribed in Table II to save life or valuable property. In such situations, the probable risk of high exposure to the rescuer must be weighed

against the expected benefits. In emergency situations which require personnel to search for and remove injured personnel or which require entry to prevent conditions that would probably injure numbers of people, the planned dose to the whole body should not exceed 100 rems. In situations where it is desirable to enter a hazardous area to protect facilities, elminate further escape of contaminates, or to control fires, planned whole body dose should not exceed 25 rems. The above guidance is based on critera set forth in the National Council of Radiation Protection Report Number 39. When an individual has been exposed to more than 3 rems during the calendar quarter, as a result of such an emergency, he shall be barred from any additional occupational exposure to radiation pending BUMED review. Such an overexposure shall be reported in accordance with the requirements of Chapter 5.

4-3. RADIATION PROTECTION STANDARDS FOR INTERNAL EMITTERS

(1) Body Retention of Radionuclides. The maximum amount of radioactive materials retained in the body (maximum permissible body burden) shall be limited to the amount which results in an exposure not to exceed the biological equivalent of 0.1 microgram of radium-226 in the bones, and 15 rems per year for other internal organs except lens of eye, bone marrow, ovary and testis, for which the radiation exposure limit is 5.0 rems per year. (Maximum permissible body burdens are listed in National Council on Radiation Protection and Measurements (NCRP) Report No. 22 (NBS Handbook 69).)

(2) Maximum Permissible Concentrations of Radionuclides in Air and Water for Occupational Exposure. The amount of radioactive material retained in the body is limited by controlling the rate of intake of such material. This is accomplished primarily by limiting the concentration of radioactive materials in the air and water in the occupational environment. Lists of the maximum permissible concentration (MPC) guides for radionuclides are published in Table I of Appendix B, Title 10, Part 20 of the Code of Federal Regulations. The MPC guides have been calculated for the dose limits set forth in article 4-3(1) and are based on lifetime occupational exposure of 40 hours per week and 50 weeks per year for 50 years.

(a) During any 7 consecutive-day period, when the number of hours of exposure is more than 40, the specified limits shall be lowered proportionately. For example, if work is for 48 hours the MPC values are 5/6 of those listed in Table I of Appendix B, Title 10, Part 20 of the Code of Federal Regulations (10 CFR 20). When deemed necessary by the Commanding Officer, the specified maximum concentration of a radionuclide may be exceeded, provided the exposure time during any 7 consecutive days is decreased proportionately from the 40-hour time limit. For example, if work is for 8 hours the MPC values are 5 times those listed in Table I of Appendix B, 10 CFR 20.

(b) Allowance may be made for use of a respiratory device, protective clothing or equipment, particle size and chemical or physical state of the radionuclide, by the NRC for NRC licensees or by Chief, BUMED for users of sources which are not licensed by the NRC. Otherwise no such allowance can be made. Each application for an exception under this subparagraph shall contain the following information:

(1) A description of the respiratory device or protective equipment to be employed, including the efficiency of the equipment for the material involved;

(2) Procedures for the fitting, maintenance and cleaning of the protective equipment;

(3) Procedures governing the use of the protective equipment, including supervisory procedures, and length of time the equipment will be used by the individuals in each work week. The proposed periods for use of the equipment by any individual should not be of such duration as would discourage observance by the individual of the proposed procedures;

(4) The average concentrations present in the areas to be occupied by employees.

4-4. CONTROL OF EXPOSURE TO RADIATION

(1) External Radiation Exposure Control. When the source of ionizing radiation is located outside the body, the following methods of control are applicable:

(a) Time. Reducing an individual's working time in a radiation field is the simplest way to limit his exposure. Since the amount of radiation received is equal to the dose rate multiplied by time of exposure, decreasing exposure time results in a proportional decrease in total exposure.

(b) Distance. Radiation intensity varies inversely as the square of the distance from a point source (i.e, a source concentrated in a small volume). Therefore, if a worker doubles the distance between himself and the source, his exposure is reduced to one-fourth; increasing the distance threefold reduces his exposure to one-ninth. Remote handling devices use this principle to reduce exposure.

(c) Shielding. Shielding materials absorb a part or all of the energy of the various types of radiation. Interposing a shield between the individual and the radiation source reduces the amount of radiation exposure.

(d) Radioactive Decay. All radioactive materials decay exponentially at a fixed time rate. The time required for a radioactive substance to decrease to one-half its original

activity is called the half-life of that particular substance. Tnus, allowing the radioactive material to decay for a period of time will reduce the amount of exposure received when the material is handled.

(2) Internal Radiation Exposure Control. If radioactive material is inhaled, ingested, or absorbed through the skin, it may be deposited in various organs or systems of the body. It then acts as a radiation source within the body and will continue to irradiate the cells of the body until it has been eliminated by biological processes and/or by radioactive decay. Risk of internal exposure is reduced by good housekeeping procedures (e.g., cleanliness, containment, protective clothing and appropriate exhaust ventilation). Personal protective measures may be accomplished by:

(a) Avoiding Inhalation. Personnel shall use prescribed face masks or respirators whenever airborne radioactivity levels as referred to in Chapter 1, are likely to be exceeded.

(b) Avoid Ingestion. No edible material of any kind including chewing gum, candy or beverages, tobacco or smoking equipment, shall be allowed in a contaminated area. Upon leaving a contaminated area personnel should not be permitted to handle any of these materials until they have been carefully monitored and decontaminated as necessary.

(c) Avoiding Absorption. Personnel shall be provided, trained in the use of, and required to wear appropriate anticontamination clothing in a contaminated area.

Chapter 5

EXPOSURE RECORDS

5-1. INTRODUCTION

All personnel occupational exposure to ionizing radiation must be documented in order to establish individual radiation exposure histories. These histories have both medical and legal significance since they record the amounts of exposure as well as dates and locations at which exposures were received. Additionally, they serve as evidence that occupational exposure limits were or were not exceeded. This chapter contains the recording and reporting procedures the Bureau of Medicine and Surgery considers necessary and adequate for occupational exposure documentation. Reporting requirements contained herein have been approved by the Chief of Naval Operations. The Health Record Custodian at each naval activity shall be responsible for the documentation, in the medical record, of all occupational exposures to ionizing radiation.

BUMED (Code 3C2), serves as the repository of radiation exposure history information for the Navy, and is responsible for the retention and retrieval of reported data. Health Record Custodians must ensure the accurate preparation and timely submission of situational and annual reports to BUMED. They must also ensure that individual Health Record entries (DD Forms 1141) and all supporting records are correct, concise, and in agreement with instructions contained in this chapter.

Naval activities holding Nuclear Regulatory Commission (NRC) licenses require additional records. These records must include the NRC license together with its amendments and related correspondence, and such other records as necessary to meet the conditions of the NRC license.

5-2. INDIVIDUAL EXPOSURE RECORD

The custodian of the individual's medical records shall prepare and maintain for each person occupationally exposed to ionizing radiation a DD Form 1141 (Record of Occupational Exposure to Ionizing Radiation) which is to be completed in

accordance with instructions below and filed and maintained in the Health Record and in no other location. A computerized printout may be used by those activities possessing automated data processing (ADP) equipment. The information on the computerized printout is to be updated at least once a quarter. The information entered on the form is to be prepared in the same sequence as it appears on the DD Form 1141 and will include all the information that is required on the DD Form 1141. This computerized printout is to be filed at least annually in the individual's medical record. A random sampling of the computerized printout shall be crosschecked against the record system or ADP records referred to in paragraph 5-4(1) of this Chapter. This crosscheck shall be performed semiannually on 1 percent of the total computerized printouts to ascertain the accuracy of the recordings. If errors are found, a larger percentage of the records should be checked. The crosscheck shall be noted by dating, signature, and verification of the accuracy of the computerized printout. For activities holding NRC licenses, the DD Form 1141 shall be used in lieu of NRC Form 4 (Occupational External Radiation History) and NRC Form 5 (Current Occupational External Radiation Exposure). A copy of DD Form 1141 is included in appendix A.

(1) Initial Determination. In the initial preparation of the DD Form 1141, reasonable effort should be made to obtain complete reports of all previous exposures based upon recorded personnel dosimetry. This shall be accomplished by correspondence with previous commands, employers and/or BUMED.

(a) For each period in which the individual was engaged in activities involving occupational exposure to ionizing radiation and no record or an incomplete record of the exposure during the period can be obtained, it shall be assumed that an occupational exposure of 3.75 rems or 1.25 rems per calendar quarter occurred. The 3.75 rems shall be assigned for unknown radiation exposure obtained prior to 1 January 1961 and 1.25 rems after 1 January 1961. Estimates of radiation exposure should be obtained prior to assigning the aforementioned values. All estimated/assigned exposure shall be determined, documented and reported in accordance with instruction in paragraph 5-2(2)(d). In cases where the nature of the radiation is unknown, it shall be assumed to be gamma radiation. In instances where the assigned exposure exceeds 5 rems in any calendar year, the results shall be forwarded by letter, with a copy of the DD 1141 or ADP printout to the Bureau of Medicine and Surgery, Code 3C2, for evaluation.

(b) When an individual was exposed at more than one facility, the cumulative exposure shall be recorded in items 7 through 14, as appropriate.

(c) If an individual has been occupationally exposed at any activity possessing a Nuclear Regulatory Commission License, and his exposures have been recorded on NRC-4 and NRC-5 forms, the cumulative exposure obtained from those forms shall be

recorded on the DD 1141 in item 7 through 14, as appropriate, and a statement regarding the source of that information shall be entered in item 16 of the DD 1141.

(2) Current Record. Appropriate entries on each individual's DD Form 1141 shall be made at least quarterly for those personnel occupationally exposed during the quarter. These entries are to be completed in accordance with instructions on the back of the form, with the exception of the column 14 entry. The maximum permissable lifetime exposure entry (column 14) is no longer applicable to the Navy radiation health program, but will continue to be recorded for administrative purposes in order to be consistent with current Federal regulations. For personnel between 18 and 19 years of age, the column 14 entry shall be 01.250 rems for the first quarter of their 19th year, 02.500 rems for the second quarter, 03.750 rems for the third quarter and 05.000 rems for the fourth quarter. Column 14 entries for all other personnel 19 years of age or older shall be determined in accordance with the instructions on the back of the DD Form 1141. For individuals who are exposed to radiation to the extremities, as defined in Chapter 4, separate DD Forms 1141 shall be maintained to record exposure to each monitored extremity, with appropriate description entered under item 16 of the form.

(a) When an individual is occupationally exposed to ionizing radiation at a naval installation or activity, other than where his medical records are maintained, the Commanding Officer, or Officer in Charge of that installation or activity shall ensure that the individual's exposure information is furnished to the custodian of the individual's medical record. This exposure information shall be forwarded to the medical record custodian at least quarterly and within 15 days of receipt of final personnel exposure information. Exposures received by visiting or temporary duty personnel whose exposures are not reported annually by their parent activities, shall be submitted to BUMED Code 3C2, on a Situational Report, MED 6470-1 or MED 6470-3 by the command where the exposure occurred.

(b) When an individual is exposed to ionizing radiation at an installation outside the jurisdiction of the Department of the Navy, he shall ensure that the exposure data is furnished to the custodian of his medical record for entry on the DD 1141, and submission on the Annual or Situational Reports, MED 6470-1 or MED 6470-3, in accordance with article 5-3 of this manual.

(c) If information for items 7 through 13 was acquired from a previous DD Form 1141 filed in the individual's health record, all previous copies of this form shall be retained in the individual's medical records.

(d) When a primary dosimetric device (e.g., a film badge or a thermoluminescent dosimeter) is lost, damaged, or destroyed, the Medical Officer, Radiation Health Officer, or Medical Department Representative, as applicable, shall be notified and exposures shall be estimated based on:

(1) Exposure time and radiation levels.

(2) Exposure of other personnel performing similar work. If exposure data for other personnel is not available, the individual's previously recorded exposure while performing similar work shall be used.

(3) Pocket dosimeter measurements, if available. All of the above procedures for estimating exposure shall be used and recorded in an investigation report, contingent on the availability of data. The investigation report should include a description of how the dosimetric device was lost, damaged, or destroyed, the exposure estimate, the period covered by the estimate, work performed by the individual during this period, a description of the investigation, results from each estimating procedure, and applicable supporting documentation (e.g., any calculations performed, copies of radiation survey records, or copies of abnormal thermoluminescent dosimeter glow curves). The investigation report shall be approved in writing by the Medical Officer or the Radiation Health Officer. For commands not having a Medical Officer or a Radiation Health Officer, the investigation report should be approved by the Medical Department Representative and the Executive Officer. The investigation report should not be entered in the individual's medical record. The investigation report should be retained indefinitely.

An exposure estimate should also be performed when the results of the primary dosimetic device are suspect. For example, an exposure estimate should be performed when the measurements of the primary dosimetric device (e.g., a thermoluminescent dosimeter) differs by 25 percent or greater from the measurements of the secondary dosimetric device (e.g., a pocket dosimeter) or when an abnormal glow curve is observed for a thermoluminescent dosimeter.

The reason why the exposure estimate was performed, the exposure estimate, the basis for the exposure estimate, and the period covered by the estimate shall be recorded in the "Remarks" section of the DD Form 1141 or on an addendum to DD Form 1141. A description of how the dosimetry device was lost, damaged, or destroyed shall not be recorded on the DD Form 1141 or on an addendum to DD Form 1141. The entry must be concise and will normally be limited to a few summary statements. If the entry is made on an addendum to DD Form 1141, the entry shall not exceed one page in length. Summary statements of less than 600 spaces concerning exposure estimates shall be transcribed to the NAVMED 6470/1 upon submission of the Annual or Situational Report of Personnel Exposure to Ionizing Radiation (Report Symbol MED 6470-1) or as a footnote on the computerized Report of Personnel Exposure to Ionizing Radiation (Report Symbol MED 6470-3).

(e) Internal Contamination. Results of all internal contamination measurements shall be recorded in the remarks section of the individual's DD 1141, Record of Exposure to

Ionizing Radiation, and Reported annually in the remarks section of NAVMED 6470/1, Personnel Exposure to Ionizing Radiation, Report Symbol MED 6470-1. The results shall include the following information: a description of the analysis equipment, the system's minimum detectable activity, the isotope(s) monitored, microcuries or nanocuries present, and the anatomical locations monitored. A form covering this information may be marked as "Addendum to DD 1141" and incorporated with the DD 1141 in the health record. Activities that have automated data processing capabilities and normally submit ADP type reports under Report Symbol MED 6470-3 will submit results of internal contamination measurements in the "Remarks" section of NAVMED 6470/1 Report Symbol MED 6470-1 or incorporate the above required information in the "Remarks" section of the NAVMED 6470/3 Report Symbol MED 6470-3. This type of submission shall not conflict with the format requirements of paragraph 5-3(5).

(f) External Contamination. Results of all cases of external contamination measurements in excess of 450 micromicrocuries of beta and/or gamma emitting contamination, or in excess of 50 micromicrocuries of alpha emitting contamination, shall be recorded in the remarks section of the individual's DD 1141, Record of Exposure to Ionizing Radiation, and reported annually in the remarks section of the NAVMED 6470/1, Personnel Exposure to Ionizing Radiation, Report Symbol MED 6470-1. The results shall include the following minimal information: isotope(s) monitored, microcuries or nanocuries present, and the anatomical location of the contamination. A form covering this information may be marked as "Addendum to DD 1141" and incorporated with the DD 1141 in the health record. Activities that have automated data processing capabilities and normally submit ADP type reports under Report Symbol MED 6470-3 will submit results of external contamination in the "Remarks" section of NAVMED 6470/1 Report Symbol MED 6470-1 or incorporate the above required information in the "Remarks" section of the NAVMED 6470/3 Report Symbol MED 6470-3. This type of submission shall not conflict with the format requirements of paragraph 5-3(5).

(g) Personnel exposure data shall be obtained and properly recorded on DD 1141. Entries should identify the installation where exposure was received and the dates of the exposure.

(h) Annual verfication of the accumulated dose (column 13 of the DD 1141) is required.

(i) If erroneous entries have been made on the DD 1141, they shall not be stricken out. A new entry which corrects the error(s) shall be made. An explanation of the error and the correction shall be briefly documented by a dated entry in block 16 (remarks). An asterisk (*) shall be neatly entered in the block containing the erroneous entry. This procedure for correcting erroneous entries on the DD 1141 supercedes the

requirements of article 16-8(7) of the Manual of the Medical Department for correction of medical record entries.

(3) Retention, Disposition and Release of Information.

(a) DD Form 1141 is a permanent component of the individual's medical records and should be safeguarded as such; however, Commanding Officers, authorized inspecting officials, and supervisors of persons occupationally exposed to ionizing radiation or the individual concerned may review DD Form 1141 with the custodian of the medical records upon request., The medical records custodian may exchange exposure data with installations outside the jurisdiction of the Department of the Navy for any persons occupationally exposed at the installation upon written request, provided a release authorization signed by the exposed individuals is forwarded with the request.

(b) When a civilian employee is not included in a Federal civilian employees health care service, DD Form 1141 or the computerized printout shall be maintained as a permanent document in his official personnel folder.

(c) If a service member is released or retired from active duty or if a civilian employee terminates employment, he shall be provided with a statement of his total occupational radiation exposure received during his period of employment or service with the United States Navy within 15 days of receipt of his final exposure information. A copy shall always be sent to CHBUMED, Code 3C2. If an individual was monitored for exposure to a radiation source licenced by the Nuclear Regulatory Commission, a copy of the termination letter shall also be forwarded to the Director, Management and Program Analysis, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. The statement shall include:

(1) Identification and employment information.

(a) The statement "This report is submitted in accordance with NAVMED P-5055, Radiation Health Protection Manual" shall be included on the form or letter provided to the individual.

(b) Name, social security number, and date of birth of the terminated individual.

(c) Dates of employment (day, month, year) and identification of the activity at which the exposure was incurred.

(d) The statement," you should preserve this report for future reference" shall be included on the form or letter provided to the individual.

(2) Exposure Information.

(a) Total cumulative occupational exposure received by the individual during his term of employment or service with the United States Navy.

(b) Types of radiation involved (X-ray, gamma, beta or neutron.)

(c) Parts of the body exposed to ionizing radiation (whole body, skin of whole body, or extremities).

The form or letter shall apprise the employee of the significance of the occupational exposure received by insertion of the following statement: "Your permissible life-time whole body dose calculated in accordance with universally accepted standards (maximum permissible dose = 5(N-18)) is _____ rems." (Note: The above statement is to be provided even though the maximum permissible exposure (5 (N-18) rems) is not applicable in the Navy's radiation health program.)

(d) If an individual was monitored for internally deposited radioactivity, the results of the examination(s) shall be summarized in the termination report. The summary should include the date of the examination(s), the minimum detectable activity of the analysis system(s), isotope(s) monitored, microcuries or nanocuries present, and the anatomical location(s) monitored.

(d) DD Form 1141 shall be permanently retained in the retired medical records of a service member who has been occupationally exposed to ionizing radiation during his service. Military personnel who are transferred, shall have their DD 1141 accompany them. All available dosimetry results shall be entered prior to transfer. Dosimetry results not recorded as of the date of transfer shall be forwarded to their next duty station within 15 days of receipt of final personnel exposure information.

(e) Copies of Annual Reports, MED 6470-1 or MED 6470-3, Personnel Exposure to Ionizing Radiation, and the Situational Reports, MED 6470-1 or MED 6470-3 shall be retained indefinitely.

5-3. REQUIRED REPORTS

(1) Annual Reports, MED 6470-1 or MED 6470-3. The medical department representative or the custodian of the health records for individuals attached to any installation, activity, ship or unit at which personnel are occupationally exposed to sources of ionizing radiation, shall submit NAVMED 6470/1, Personnel Exposure to Ionizing Radiation, MED 6470-1, or MED 6470-3 in punch card format annually to BUMED, Code 3C2, within 30 days of receipt of final personnel exposure information. This report shall include those personnel on board 31 December who have been occupationally exposed to ionizing radiation during the previous calendar year while assigned to the reporting activity. (see article 5-3 (2)(b). Dosimetry readings of 00.000 rem are required to be recorded. If the individual was not monitored for a given type of radiation, leave the appropriate column blank.

(2) Situational Reports, MED 6470-1 or MED 6470-3.

(a) If an exposed individual is transferred, retires or terminates employment, MED 6470-1 submitted on NAVMED 6470/1 or MED 6470-3 in punch card format, shall be prepared and forwarded to BUMED, Code 3C2, by the individual's activity within 30 days of receipt of the individual's final exposure information.

(b) If a visitor at a naval facility or an individual on temporary duty from an activity which does not submit annual or situational reports, is monitored for exposure to ionizing radiation, a situational report MED 6470-1 submitted on NAVMED 6470/1 or MED 6470-3 in punch card format, shall be prepared and forwarded to BUMED, Code 3C2, by the activity at which the exposure was incurred within 30 days of receipt of the individual's exposure information.

(3) Reports of Personnel Exceeding Radiation Exposure Limits, MED 6470-2. This report shall be submitted to BUMED, Code-3C2, as follows:

(a) If any individual receives a whole body dose in excess of the whole body exposure limits specified in article 4-2(4)(a), this report shall be forwarded on NAVMED 6470/1 within 30 days from the determination of such exposure.

(b) If any individual receives a whole body dose of more than 5 rems in a single incident, this report shall be forwarded on NAVMED 6470/1 within 24 hours from the determination of such exposure.

(c) If any individual receives a whole body dose of more than 25 rems in a single incident, BUMED, MED-3C2, shall be notified immediately by priority message. During "MINIMIZE," electrical transmission by priority message is authorized. In addition, a detailed NAVMED 6470/1, furnishing all information available on the overexposure, the reason for such overexposure, the general status of health and physical condition of the individual and a summary of treatment rendered or recommended, shall be submitted to BUMED, Code 3C2, at the earliest practicable date following the incident. In any event, this amplifying report must be submitted within 15 days after exposure. A copy of this report shall be placed in the individual's health record as an addendum to the DD 1141 form.

(4) Instructions for Completion of NAVMED 6470/1 Report of Personnel Exposure to Ionizing Radiation.

(a) In the heading of the form, check the two appropriate boxes to indicate, 1) whether the report is an Annual Report or a Situational Report and, 2) whether it is a Report of Personnel Exposure to Ionizing Radiation, MED 6470-1 or a Report of Personnel Exceeding Radiation Exposure Limits, MED 6470-2.

(b) Items 1 through 17.

1	Enter name and address of reporting activity.
2	Enter Reporting Facility Code. The reporting facility code is devised as listed in Article 5-3(5)(field 3).
3	Enter calendar year reported.
4	Enter date reported.
5	Enter name as currently carried on rolls-last name, first name and middle initial, as appropriate. If this combination exceeds 19 spaces, enter last name and initials only.
6	Enter individual's Social Security Account Number.
7	Enter individual's year and month of birth. Enter last two digits of the year; enter month in 2 digits using the appropriate code from the series 01 through 12.
8	Enter year, month, and day exposure was considered to have started since last report, i.e., 70-01-01.
9	Enter year, month and day exposure was considered to have ended, i.e., 70-12-31.
10-14	Enter radiation doses received to three decimal places, i.e., 03.450. Enter doses evaluated as "zero" as 00.000. Zero exposures are equally as important as positive readings for medico-legal purposes. Do not use "X's" or term "minimal." If the individual was not monitored for a specific type of radiation exposure (e.g., skin dose or neutron), leave the field blank.
10	Enter skin dose in rem.
11	Enter X-ray and Gamma dose in rem.
12	Enter Neutron dose in rem.
13	Enter accumulated dose for this period; sum of items 11 and 12. This entry should normally be only for the current calendar year. Previous year's exposure should have already been reported on prior annual reports.
14	Enter Total Lifetime accumulated dose in rem.
15, 16, 17	Self Explanatory.

(5) Preparation of MED 6470-3, Personnel Exposure to Ionizing Radiation. Those activities having automatic data processing equipment may use punch cards and tabulated reports in lieu of NAVMED 6470/1. The format of the report, Personnel Exposure to Ionizing Radiation, is assigned Report Symbol MED 6470-3. IBM 5081 or other similar type stock card form shall be used. Punch cards shall be submitted in alphabetical order. All information on the tabulated report shall be printed in the same sequence in which it appears in the punch cards. The punch cards and the tabulated listing containing the name and address of the activity shall be prepared as follows and submitted annually to

BUMED, Code 3C2, within 30 days of receipt of final exposure information for all personnel onboard, and situationally as required:

Field

1 Card Code Punch 20 in card columns 1 and 2.

2 Leave card column 3 blank.

3 Reporting Facility Code. Punch facility code number in card columns 4 through 9 to identify the reporting facility. This code is devised as follows for all ships and stations having medical department personnel.

(a) First Digit. The first digit of the facility code shall be assigned to identify the type of reporting facility as follows:

0 Naval Hospitals and Hospital Ships
2 Dispensaries with Authorized Operating Beds
3 Naval Dispensaries
4 Other Dispensaries, Shore Activities and Medical Departments in Mobile Activities
5 Ships (except MSTS ships)
6 Ships, MSTS
7 Marine Corps FMF Units
8 Construction Battalions
9 Other Mobile Units

(b) Last Five Digits. The last five digits of the facility code shall be assigned the same as the Unit Identifier Code (UIC) listed in the Navy Comptroller Manual, Volume 2, Chapter 5. If the Unit Identifier Code number is less than five digits, precede the number with zeros.

4 Name. Punch name as currently carried on the rolls-last name, first name, middle initial as appropriate-in card columns 10 through 28. Limit to 19 columns by using last name and initials, if necessary.

5 Social Security Number. Punch individual's social security number in card columns 29 through 37. For foreign military personnel punch FM (for foreign military) in card columns 29 and 30, followed in card columns 31 through 37 by the individual's service number. If service number contains more than 7 digits, use the last 7 digits of the number; if less than 7 leave unused card columns to the right blank. For foreign civilian employees punch FC (for foreign

civilian) in card columns 29 and 30, followed by the employee's pay number starting in card column 31. Leave blank any unused card columns to the right in the 9-digit field.

6 Birth, year and month. Punch individual's year of birth in card columns 38 and 39. Punch month of birth in card columns 40 and 41. Use 01-09 for January through September and 10, 11, and 12 for October through December respectively.

7 Age. Punch individual's age in card columns 42 and 43.

8 Exposure Date. Punch year, month and day on which exposure began as follows: year in card columns 44 and 45; month in card columns 46 and 47; day in columns 48 and 49. In the same order and manner, punch year, month and day exposure ended in card columns 50 through 55. Use 01-09 for months and days so identified that have less than 2 digits.

9 Skin Dose. (Formerly identified as Beta dose). Punch skin dose as determined from film badge, in rem, in card columns 56 through 60. If not monitored, leave the field blank. Zero exposures must be recorded.

10 X-ray and Gamma Dose. Punch combined gamma and x-ray dose, as determined by the appropriate dosimetric devices, in rem, in card columns 61 through 65. If not monitored, leave the field blank. Zero exposures must be recorded.

11 Neutron Dose. Punch neutron dose, as determined by the appropriate dosimetric device, in rem in card column 66 through 70. If not monitored, leave the field blank. Zero exposures must be recorded.

12 Total Dose This Period. Punch the total of field 10 (x-ray and gamma dose), and field 11 (neutron dose) for this reporting period in card columns 71 through 75. Zero exposures must be recorded.

13 Total Lifetime Dose. Add the total dose this period (field 12) to the previous total lifetime dose (item 13, DD 1141) and punch the sum in card columns 76 through 80. Punch all radiation doses to three decimal places. Zero exposures must be recorded. These are equally as important as positive readings for medico-legal purposes.

5-4. RECORD KEEPING

(1) Working copy of NAVMED 6470/1. To maintain accurate DD 1141's and to submit accurate NAVMED 6470/1's a reliable record system is essential. It is suggested that each activity's record system contain a working copy of NAVMED 6470/1 on which is transcribed all required data from DD Form 1141 on any persons transferred during the month. For activities which have automatic data processing equipment, ADP records are satisfactory. This data shall be updated when the personnel dosimetry is processed and used to prepare the Situational Report (NAVMED 6470/1). The working copy of the NAVMED 6470/1 may be destroyed when the

required situational report is submitted. A file copy of the situational/annual reports must be maintained indefinitely.

(2) Film Log. A log containing the film number, name, date, time of issue and return, and type of radiation monitored is suggested for all activities utilizing film badges.

(3) Film File. The film file shall be maintained by filing film in the most expeditious manner in which retrieval and identification is possible. A suggested practical method of maintaining a film file is to stack the film, including controls, from one processing period in numerical order, secure with a rubber band and place in a suitable box or envelope for storage. This container is to be identified as to the activity and processing period. For ease of retrieval, storage containers should be maintained in chronological order. Processed film and associated photodosimetry work sheets shall be retained for the current year and one subsequent year, after which they shall be discarded.

Chapter 6

PERSONNEL DOSIMETRY

6-1 BACKGROUND

Personnel dosimetry is a technique for detecting and measuring an individual's exposure to ionizing radiation. The Bureau of Medicine and Surgery requires naval activities to maintain a dosimetry program for personnel who are occupationally exposed to ionizing radiation. Personnel dosimetry is utilized to document an individual's radiation exposure and to aid in minimizing exposure. Personnel dosimetry has both medical and legal significance and must be conscientiously practiced by trained personnel under competent supervision.

6-2 RESPONSIBILITIES

(1) Command. The Commanding Officer of any Naval activity where military or civilian personnel may be exposed to ionizing radiation shall maintain a Radiation Health Protection Program. The Radiation Health Protection Program will be administered by the Medical Department and shall be supervised by the Radiation Health Officer or his assigned equivalent. The Commanding Officer shall ensure that appropriate personnel dosimetric devices are supplied and he shall require the use of such devices (1) by all personnel who are likely to exceed a whole body dose of 300 mrem per calendar quarter, (2) by all personnel entering a high radiation area (i.e., an area where exposure rate is greater than 100 mrem/hour), and (3) by all personnel as deemed necessary. The type of dosimetric device or devices used to produce the legal personnel exposure record shall be specified by the Commanding Officer and approved by Chief, BUMED. Unless other types of dosimetry are approved by BUMED, the dosimetry program shall be based on photodosimetry and/or thermoluminescent dosimetry as described in this chapter, and its establishment shall be under the cognizance of the senior medical representative present. Organizations associated with the Naval Nuclear Propulsion Program perform dosimetry in accordance with the

appropriate NAVSEA radiological controls manual. All radiographers and radiographers' assistants as defined in Title 10, Part 34 of the Code of Federal Regulations, shall wear a self-indicating dosimeter and either a film badge or a thermoluminescent dosimeter. All medical personnel shall wear a finger ring extremity dosimeter when compounding and administering radiopharmaceuticals.

(2) Individual. When a personnel dosimetric device is required, it shall be worn at all times in any area where occupational radiation exposure may occur. The individual is responsible for loss of, or damage to such a device while in his possession. At the end of the working period, the dosimetric device shall be placed in a low background area. It is also the individual's responsibility to know his current quarter, annual, and total lifetime whole body dose. This information may be obtained from the health record custodian or radiation health/safety officer.

6.3 DOSIMETRIC DEVICES

Acceptable dosimetric devices include: (1) film badges, (2) pocket dosimeters, (3) wrist badges and finger rings, (4) luminescent dosimeters, and (5) accident dosimeters.

(1) Film Badges. Film packets contain one or more photographic emulsions with varying degrees of sensitivity to beta particles, gamma rays, and x-rays. Film packets are placed in the standard Navy stainless steel film badge holders, which are designed to differentiate between these radiations. Film badge holders are provided with a clip or other suitable means for attachment to the individual's clothing.

(2) Pocket Dosimeters. Pocket dosimeters are pencil shaped ionization chambers calibrated to measure integrated exposure to gamma or x-ray radiation. For monitoring x-ray exposure, only those pocket dosimeters capable of measuring low energy radiation shall be used. They are self-indicating and available in several exposure ranges (e.g. from 0-200 mrem and 0-600 rems).

(a) Use. Pocket dosimeters should be used in addition to other dosimetric devices when high levels of radiation may be encountered, or when frequent exposure estimates are required. The use of a self reading pocket dosimeter allows personnel to monitor their own exposure. When used in addition to other dosimeters, the pocket dosimeter shall be worn in close proximity to the other dosimeter. The choice of the type and the number of pocket dosimeters shall be made by the Radiation Control Officer or the Radiation Health Officer.

(b) Reliability Tests. Pocket dosimeters must be tested for both drift and accuracy. These tests will be performed in accordance with the Naval Electronic Systems Command standard maintenance and calibration procedures for dosimeters.

(3) Wrist Badges and Finger Rings. For certain special situations, the wearing of wrist badges or thermoluminescent dosimeter (TLD) rings to measure radiation exposure to the extremities may be required. Information regarding these devices may be obtained from the BUMED Dosimetry Center, National Naval Medical Center, Bethesda, Maryland 20814.

(4) Luminescent Dosimeters. This includes both photoluminescent and thermoluminescent devices. The DT-60/PD, which the Navy issues for use in Nuclear, Biological and Chemical warfare (NBC) defense is a silver phosphate photoluminescent dosimeter. The DT-60/PD will detect up to 600 rems of gamma radiation, provide an estimate of integrated dose over a long period of time, provide a permanent record of exposure, and is reusable. Thermolumi- nescent dosimeter (TLD) systems are capable of detecting exposure in the range of zero to 10,000 rems, give integrated doses over long periods, and are reusable. Two commonly used thermoluminescent materials are lithium fluoride and calcium fluoride.

6-4 DOSIMETRY PROCESSING

Bureau of Medicine and Surgery Dosimetry Center. The Center is designated as the processor of all photodosimetry, the DT-583 LiF TLD, and LiF TLD chips used for extremity monitoring. The center has processing equipment, calibration sources, and a staff capable of evaluating various types of dosimetry and providing technical assistance in matters regarding personnel dosimetry. Dosimetry processing by other facilities requires BUMED approval.

6-5 PHOTODOSIMETRY PROGRAM

(1) Background. Photodosimetry is a dose measuring technique which utilizes photographic emulsions sensitive to ionizing radiation to determine an individual's exposure. Radiation passing through a grain of silver halide in the emulsion causes a change, resulting in the conversion of the grain to free silver. When the film is developed the silver causes a blackening of the emulsion which is measured as an increase in the optical density of the film. With proper calibration, this darkening is related to the magnitude of radiation exposure.

(a) Factors. To obtain accurate results, it is necessary to be consistent in all photodosimetric procedures. Among the many factors which affect film density are (1) emulsion type, (2) background density or base fog of the film (3) type of film badge utilized, (4) type, concentration, age and temperature of the developing solution, (5) development time, (6) amount of agitation during development, (7) fixing time, (8) accuracy of the densitometer, and (9) operator training.

(b) Density. To relate density to exposure, it is necessary to use a film calibration curve specifically developed for the type of film and radiation being monitored. Film

calibration curves are developed for specific types of radiation and film that are processed by set procedures. Other variables must be controlled as follows:

(1) Emulsion control film shall be used to subtract base fog in order to obtain a net density for evaluation.

(2) Emulsion control film shall be kept in an environment where temperature and humidity factors are similar to those where film are being worn or exposed. Control film must not be exposed to radiation above natural background levels.

(3) Kodak Type 3 film is extremely sensitive to X-ray and gamma radiation. This film must not be stocked near sources of radiation unless adequate shielding is provided.

(4) All photographic film is subject to fogging by certain chemical vapors such as mercury, ammonia, or sulfur. Storage in areas where these vapors may exist must be avoided, especially after the stock package has been opened and the vapor seal broken.

(5) Unopened packages of stock film should be stored at 35 to 50 degrees F. Opened packages should be stored at room temperature and humidity. Temperatures above 70 degrees F and humidity above 50% should be avoided whenever possible. If opened packages are returned to cold storage, the vapor seal must be secured to prevent the formation of condensation when the cold film packets are again removed from cold storage. Wrapping in plastic alone is not adequate to secure the vapor seal.

(6) The extreme variation of film response with photon energy complicates the evaluation of exposure to energies below 0.2 MeV. For gamma rays of 0.2 MeV to 3 MeV, the film response is essentially constant. Exposures to radiation with photon energy below 0.2. MeV require specific calibration curves which are applicable to the photon energies of concern.

(2) Standard Photodosimetry Equipment

(a) Photographic Emulsions

(1) Film Description and Availability. Film Radiac Pack, NSN 6665-00-935-4327, Kodak Type 3, shall be used for detecting x-ray, beta, and gamma radiation. Each film packet contains two pieces of film, fast or "sensitive', and slow or "insensitive". In the film packet, the fast film is always in front of the slow film. The front of each packet is marked with a prefix letter followed by a 5-digit serial number for identification. This number appears on both film within the packet. Type 3 film is available from the following distribution points: (1) SUBASE, New London, CT; (2) NSC, Norfolk, VA; (3)

NSC, Charleston, SC; (4) NSC, Oakland, CA; (5) NSC, Long Beach, CA; (6) NSC, San Diego, CA; (7) NSC, Pearl Harbor, HI; (8) NSC, Puget Sound, Bremerton, WA.

(2) Sensitivity. In general, film sensitivity varies with the type and energy of exposure. However, this occurs almost entirely at energies below 0.2 MeV. For example, an exposure of 0.020 rem of high energy gamma produces only 0.05 density units on Type 3 film, while a similar exposure to lightly filtered 80 KVp diagnostic x-ray (approximately 30 KeV effective) results in a density of 1.2. Thus, the Type 3 film is about 24 times more sensitive to low energy x-rays. The high sensitivity peak varies only slightly for lightly filtered x-ray energies in the range of 60 KVp to 120 KVp. Therefore, a standard calibration curve may be used for most exposures from diagnostic x-ray equipment.

(3) Useful Range. The sensitivity of the Type 3 film packets limits its useful range to 00.001 to 20 rems for x-ray exposures, 00.016 to 400 rems for gamma exposures, and 00.016 to 800 rems for beta exposures. If exposure above the useful range of the Type 3 film packet is anticipated, alternative dosimetric devices shall be used.

(b) Film Badge Holders. The film packets are placed in film badge holders having various absorbers of different densities to differentiate between energies and type of ionizing radiations. The holder, Radiac Detecting Element NSN 6665-00-299-9825, is the standard item of issue and will be used in all cases unless prior approval is granted by BUMED, Code 3C2. This is constructed of stainless steel and provides five areas for density measurements: (1) "open window", (2) cadmium, (3) single steel, (4) double steel, and (5) cadmium plus single steel. Figure 6-1 illustrates the different areas of the badge. The holder is equipped with a clip for fastening to an outer garment of the person being monitored. Any modification of this holder, other than modifications promulgated by instructions or notices or the adoption of a different film badge, must have prior approval of BUMED, Code 3C2. As exceptions, belt loops which enable the badge to be worn on the belt and wrist bands which enable the badge to be worn on the wrist may be installed on the back side without prior approval. Removal of the spring clip must be approved by BUMED, Med 3C2. Type 3 film packets shall be placed in the film badge holders so that the letter designator preceding the serial number lies forward at the open window end. A back-up Type 3 film packet must be placed behind the front film packet. The back-up film should be given a distinctive mark and left in the badge for reuse. Back-up film is necessary in all cases. Without "back-up" film, exposure to energies above 0.660 MeV will appear 15% to 20% high. This is a result of unattenuated back-scatter from the rear cadmium shield.

(1) Normal Use. The film badge shall normally be worn on the front surface of the trunk of the body, in the area expected to receive the highest exposure. When the location of maximum exposure to the body is not certain, additional dosimeters and/or film badges shall be worn. The film badge shall be worn at the front collar while performing certain diagnostic radiology examinations which require a leaded apron to be worn. The wearer is responsible for his badge and the contained film and should take care to avoid its exposure to excessive heat, humidity, or moisture. Writing on any portion of the film packet other than the narrow area above the serial number (front or back) shall be avoided due to the pressure sensitive nature of the film emulsion.

(2) Additional Use. The film badge may be used as a means of identification for security purposes, provided the security program does not conflict with the photodosimetric program. Numbering or other identification may be placed on the clip, on the edge of the badge or on the steel strip between the open window and cadmium shield. Any additional alteration of the film badge must be approved by BUMED, Code 3C2.

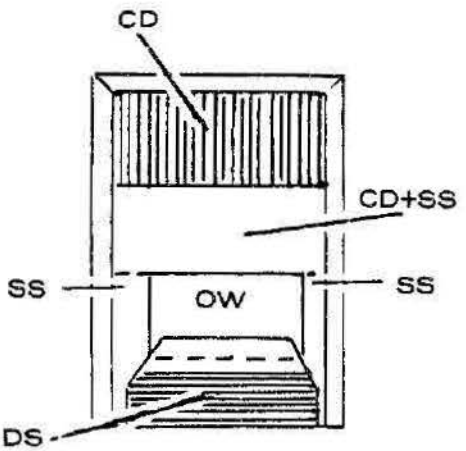


FIG. 6-1. Film Badge showing different areas where film densities may be measured.

(3) Photodosimetry Program

(a) Initiation. To obtain photodosimetry service, submit a letter request to Chief, Bureau of Medicine and Surgery (Code 3C2), Navy Department, Washington, D.C. 20372 and state the

number of individuals to be monitored, the source and the types of radiation to be monitored and the activity's Unit Identification Code (UIC). BUMED through the BUMED Dosimetry Center, will forward Photodosimetry Report forms, caution labels for placing on mailing containers, and a facility code that is used to identify the command. The command is responsible for obtaining film and film badges.

(b) Issue and Collection. Film badges are to be issued for a period of one month. The first issue period of a calendar year shall begin on any date in January. Upon issue, information required on the Photodosimetry Report shall be entered according to the instruction on the reverse side of the form. At the end of the issue period all personnel and posted film badges shall be collected, placed in the same numerical order as they appear on the report form and submitted to the BUMED Dosimetry Center within five working days after collection, with an original and one copy of the report form. If replacement film is not available at the end of an issue period the issue period may be extended until replacement film is available. If an extension of an issue period is initiated due to nonavailability of replacement film, BUMED (Code 3C2), shall be notified by message. Prior to placing a newly opened package of TYPE 3 film in an issue status, one film from each end and one film from the central portion shall be submitted to the BUMED Dosimetry Center for processing and evaluation to ensure the base fog is within the normal range of about 0.30 density units for fresh film and not over 0.60 density units for film approaching its expiration date. Preissue film may be included with a regular submission to the Dosimetry Center or forwarded as a special submission.

(c) Control Film. Each submission of film must include the number of control film required in the instructions on the reverse of the Photodosimetry Report. The evaluation of the control film is used by the Dosimetry Center to subtract the base fog from issued film. The evaluation of control film is reported in density units.

6-6 LITHIUM FLUORIDE THERMOLUMINESCENT DOSIMETRY PROGRAM

(1) Background. The Lithium Fluoride Thermoluminescent Dosimeter, DT-583, referred to as the LiF TLD, is capable of detecting gamma, x-ray and neutron radiation. The LiF TLD may be issued to monitor personnel for gamma radiation (greater than 80 KeV) and/or neutron radiation. The LiF TLD may also be issued to monitor personnel for x-radiation from x-ray devices operated at 250 KVp potential or greater. Other uses are not authorized without approval of the Bureau of Medicine and Surgery. The LiF TLD card contains two lithium fluoride chips, as shown in figure 6-2. Chip number one has been enriched with lithium six which will respond to gamma radiation and thermal neutron radiation. Chip number two has been enriched with lithium seven which will only respond to gamma radiation. The amount of gamma radiation to which the LiF TLD has been exposed is determined directly by reading chip number two. When neutrons enter the body, a

percentage of them are thermalized and reflected out of the body. The number of thermalized neutrons reflected is proportional to the number and dependent on the energy of the neutrons entering the body. When the LiF TLD card, in its holder,

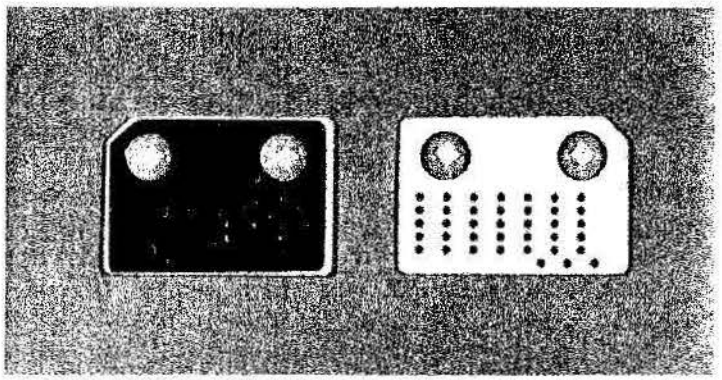


FIG. 6-2 LiF TLD Card, a. front and b. back

figure 6-3, is worn next to the body, the lithium six chip will detect reflected thermal neutrons. A cadmium filter is placed in the TLD holder to capture thermal neutrons incident to the front of the dosimeter. The difference between the reading of chip number two (gamma dose) and chip number one (gamma plus neutron dose) is used to determine the neutron dose to the body. The range of the LiF TLD is zero to 10,000 rems.

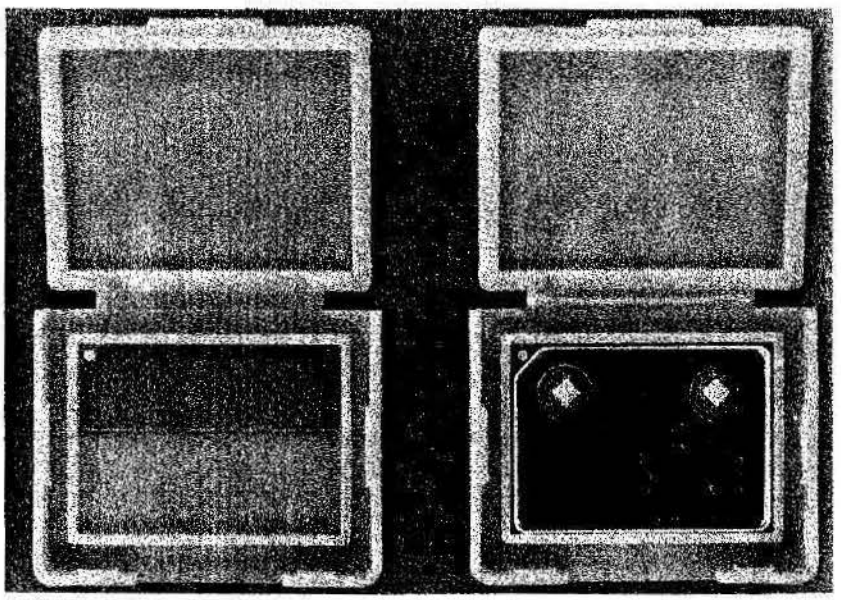


FIG. 6-3 LIF TLD holder and card placed in holder for a personnel dosimeter.

(2) Factors affecting accuracy. The LiF TLD is not as sensitive as photodosimetry film to environmental extremes, and does not require cold storage. However, to achieve the most accurate results, the following factors must be controlled:

(a) LiF TLD cards must be kept clean. Spurious dose readings can result if the card is soiled or chemically stained. Cards may be cleaned locally using a sponge with mild detergent and water. Do not use chemical solvents or cleaning fluids on LiF TLD cards.

(b) Damaged cards, such as bent, broken, missing components, permanently soiled or stained, should be noted by a comment in the remarks section of the NAVMED 6470/3. The Dosimetry Center can repair most types of damage and accurately evaluate the TLD provided the damage is recognized before the card is processed.

(c) Sunlight and fluorescent light can, after prolonged exposure, induce false TLD readings of up to 20 mrem. This occurs only if the TLD card is exposed to light for several hours while removed from the badge. Thus, bare LiF TLD cards should be stored in the dark when not in use. Also, control cards should be kept with the unused cards so that the control readings include the effect of any prolonged light exposure which may have occurred.

(d) Static electricity or electrical discharge can cause spurious dose readings on LiF TLD cards. This occurs only if the bare cards are subjected to such treatment while removed from the badge. If it is suspected that this has occurred, a description of the event should be included in the remarks section of the NAVMED 6470/3.

(e) High ambient temperatures (over 115° F) cause reduced sensitivity of the LiF TLD and will result in dose evaluations being as much as 25% low. If a LiF TLD is used where the ambient temperature exceeds 115° F on one or more days during the issue period, note in the remarks section of the NAVMED 6470/3 "TLD #_____ exposed to temperatures above 115° F". The Dosimetry Center will employ special evaluation methods for such TLDs.

(f) The LiF TLD is extremely sensitive to low level radiation, including background radiation. When issued personnel badges are not being worn, they should be stored in an area removed from radiation sources. Likewise, control and unissued LiF TLD cards shall be stored in an area removed from radiation sources.

(3) Initiation of the program. Requests for Lithium Fluoride Thermoluminescent Dosimetry are to be made to the Chief, Bureau of Medicine and Surgery (Code 3C2), Navy Department, Washington, DC 20372. Activities shall send requests via their

respective chains of command. The request shall indicate the number of personnel and environmental devices required, the type of radiation to be monitored, and the activity's unit identification code. The LiF TLDs will be shipped, as a group, directly to the requesting command or its supporting medical facility. Dosimeters from different groups or shipments shall not be mixed.

(4) LiF TLD cards and holders. Upon initial implementation, yellow plastic holders and LiF TLD cards are provided to the user by the BUMED Dosimetry Center. Personnel dosimeters contain one LiF TLD card, placed in the yellow holder so that the clipped corner is adjacent to the peg in the holder. A special opening device, figure 6-4, shall be used to open the yellow plastic holder. Opening devices are available from the BUMED Dosimetry Center. Special care must be exercised when positioning the blade under the belt loop and the tip of the opener into the protrusion of the yellow holder. If not positioned properly, the strap on the holder will be torn loose when opening pressure is applied.

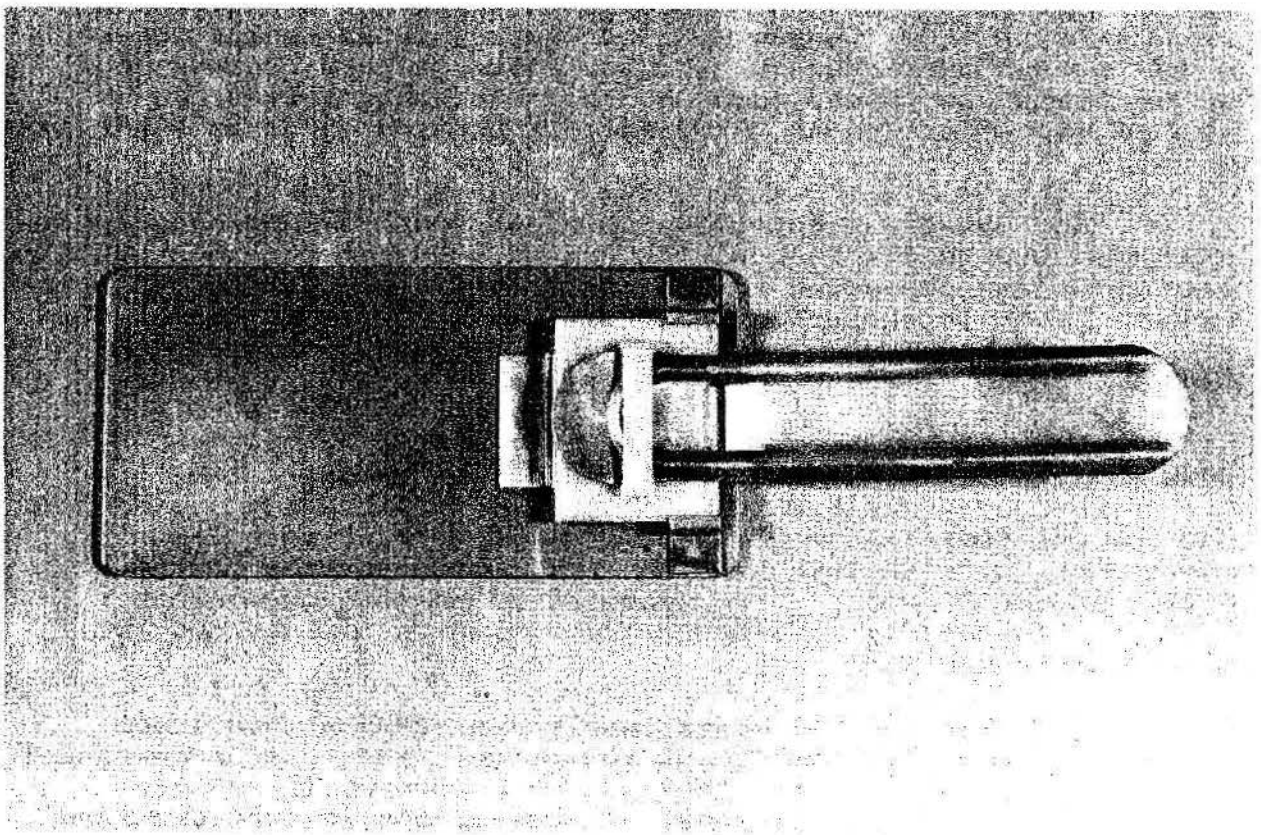


FIG. 6-4 LiF TLD Opening Device

(5) Wearing the LiF TLD. The holder with card enclosed shall be worn at waist level on the front of the body, using the belt loop, figure 6-5, so that the side with the belt loop

remains against the body at all times. If the TLD is worn backwards, i.e., the side with the belt loop away from the body, the neutron exposure cannot be evaluated. If good body contact is not maintained, then the recorded neutron exposures may also be in error. In these two cases, the recorded neutron exposure may be significantly higher or lower than the actual exposure depending on the circumstances involved in the exposure. If during a certain procedure, it is suspected that the chest will receive a higher exposure than the waist, the LiF TLD shall be worn at chest level on the front of the body with proper contact being maintained between the TLD and the body. The wearer shall be instructed not to open the holder as the LiF TLD card may be damaged or replaced incorrectly.

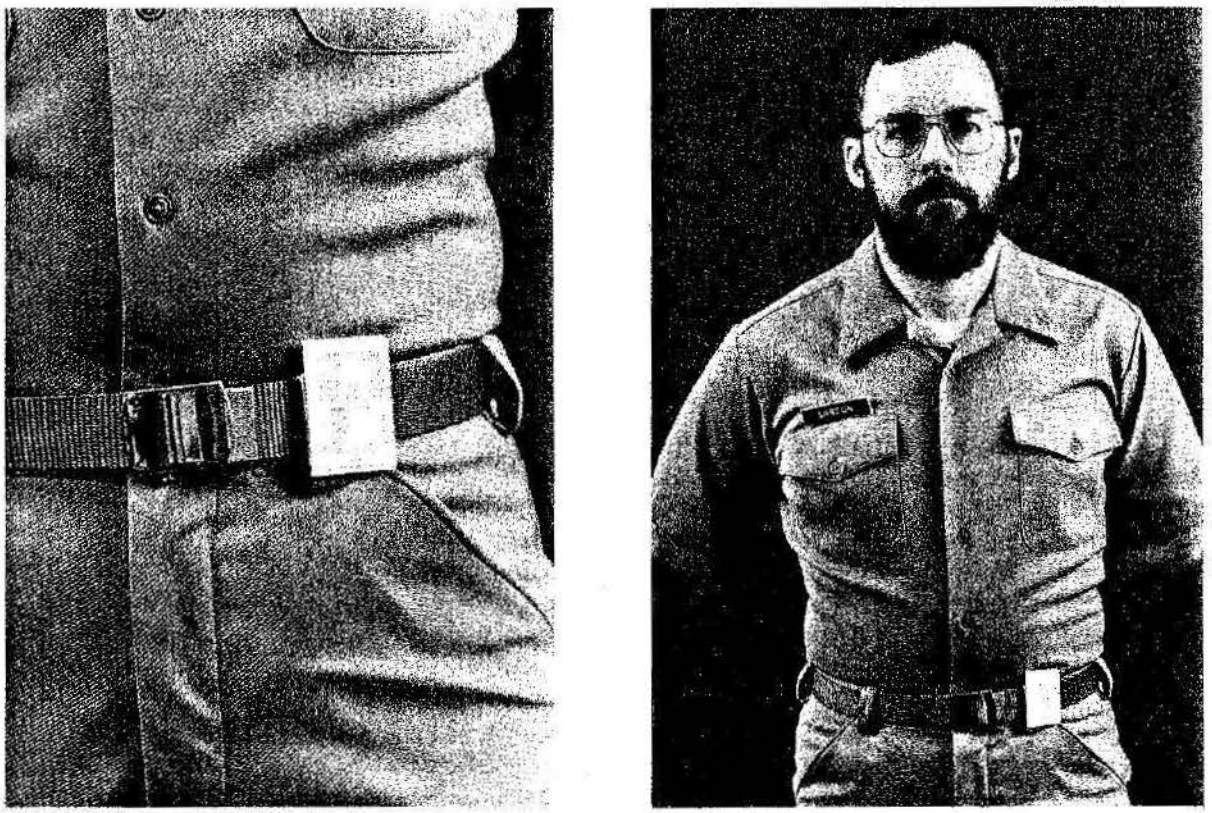


FIG. 6-5 Proper location of the LiF TLD on the trunk of the body and with the belt loop toward the body

(6) Issue. The issue period for the LiF TLD shall be:

(a) Six to seven weeks (i.e. twice per quarter), except as provided below:

(1) For personnel assigned to Fleet Ballistic Missile Submarines, the issue period shall be for the duration of a patrol cycle.

(2) For personnel who are issued a LiF TLD for a particular job of less than six weeks duration, the issue period should be for the duration of the job.

(3) For personnel suspected of having exceeded an exposure limit, their LiF TLD and two control TLDs shall be submitted for evaluation as soon as practicable.

(4) If exchange LiF TLDs are not available at the end of an issue period, the issue period may be extended until dosimetry is available. If an extension of an issue period is initiated, the activity shall notifiy, by message, Commanding Officer, National Naval Medical Center, Bethesda, Maryland 20814 (Code C45) of its dosimetry requirements. LiF TLDs shall not be kept for greater than 150 days without BUMED approval.

(b) The same for posted dosimeters as that used for personnel.

(c) Started so as to allow an individual's radiation exposure record to be updated quarterly. The definition of a calendar quarter is given in Chapter 1 of this manual.

(7) Control LiF TLDs. Two control LiF TLD cards, which must be from the same group as the issued LiF TLDs, shall be included in each submission for evaluation. Control LiF TLD cards shall be stored in an area of low background radiation, not in the proximity of any radiation sources. The control LiF TLD cards shall be listed first on the NAVMED 6470/3 that accompanies the submission. The reading of the control cards will be listed on the NAVMED 6470/3 by the BUMED Dosimetry Center.

(8) Collection. The LiF TLD cards shall be removed from their holders and submitted to the BUMED Dosimetry Center within five working days following collection. When removing the LiF TLD card from the yellow holder, observe any change in orientation from that in figure 6-3 and report such in the remarks section of the NAVMED 6470/3. The cards shall be arranged in the same numerical order as they are listed on the NAVMED 6470/ 3, packed in the shipping container and forwarded for evaluation. Cards may be loosely bound or wrapped in paper to maintain order, but use of any adhesive fastening tape that contacts the cards or rubber bands is prohibited. Forward the original NAVMED 6470/3 with each submission. Each shipment shall

be sent via traceable means, i.e., registered or certified mail. For LiF TLD devices that were exposed to a bare or unmoderated neutron source, the entry shall be footnoted and the terms "Bare Neutron Source" placed in the remarks sections of the form. This notation is important because a different LiF TLD system laboratory calibration is used for bare neutron source exposures. A bare source is defined as an exposure situation in which it is possible for the radiation worker to see the actual source or source capsule with no intervening shielding or other material.

(9) Area Monitoring. Dosimetry devices may be posted in or around specific areas to obtain information on ambient radiation levels.

(a) Gamma/Photon Monitoring. The LiF TLD card placed in its yellow holder constitutes a gamma/photon monitor. No special mounting or phantom is required; however, the device should be oriented so the front of the dosimeter faces the direction of the radiation source. The holder contains a cadmium strip which provides some shielding for the two LiF TLD chips. Therefore, using the LiF TLD for monitoring gamma radiation below 80 KeV or x-rays from x-ray generators operated below 250 KVp is not authorized.

(b) Gamma and Neutron Monitoring. Two systems are available for use when monitoring areas for gamma and neutron radiation. Both systems employ a phantom to reflect or moderate incident fast neutrons.

(1) Gamma/Neutron Posted TLD Monitor. This monitor, figure 6-6, consists of two LiF TLD cards placed in a standard yellow holder which has the belt loop removed. This is an albedo neutron detection device which detects thermal neutrons reflected from the phantom as well as incident photons. The holder is attached with tape or other adhesive to the center surface of a 6 inch x 6 inch side of a 6 inch x 6 inch x 3 inch polyethylene or Lucite block. The block and mounting brackets may be fabricated locally. The block shall be mounted in such a manner that the LiF TLD badge faces the source of radiation. To load the holder, place the holder down as shown in figure 6-7. Then place the first card in the holder with the clipped corner adjacent to the yellow peg, so that the LiF TLD chips are over the cadmium and the serial number on the TLD is visible. Place the second card on top of the first, with the LiF TLD chips not over the cadmium and the metallic side of the TLD up as shown in figure 6-7. After both cards are positioned, close the holder insuring that all catches are engaged. Enter the term "posted TLD" in column 4 of the NAVMED 6470/3, then list the number of the first card loaded in the holder in column 5 and the number of the second card in column 6.

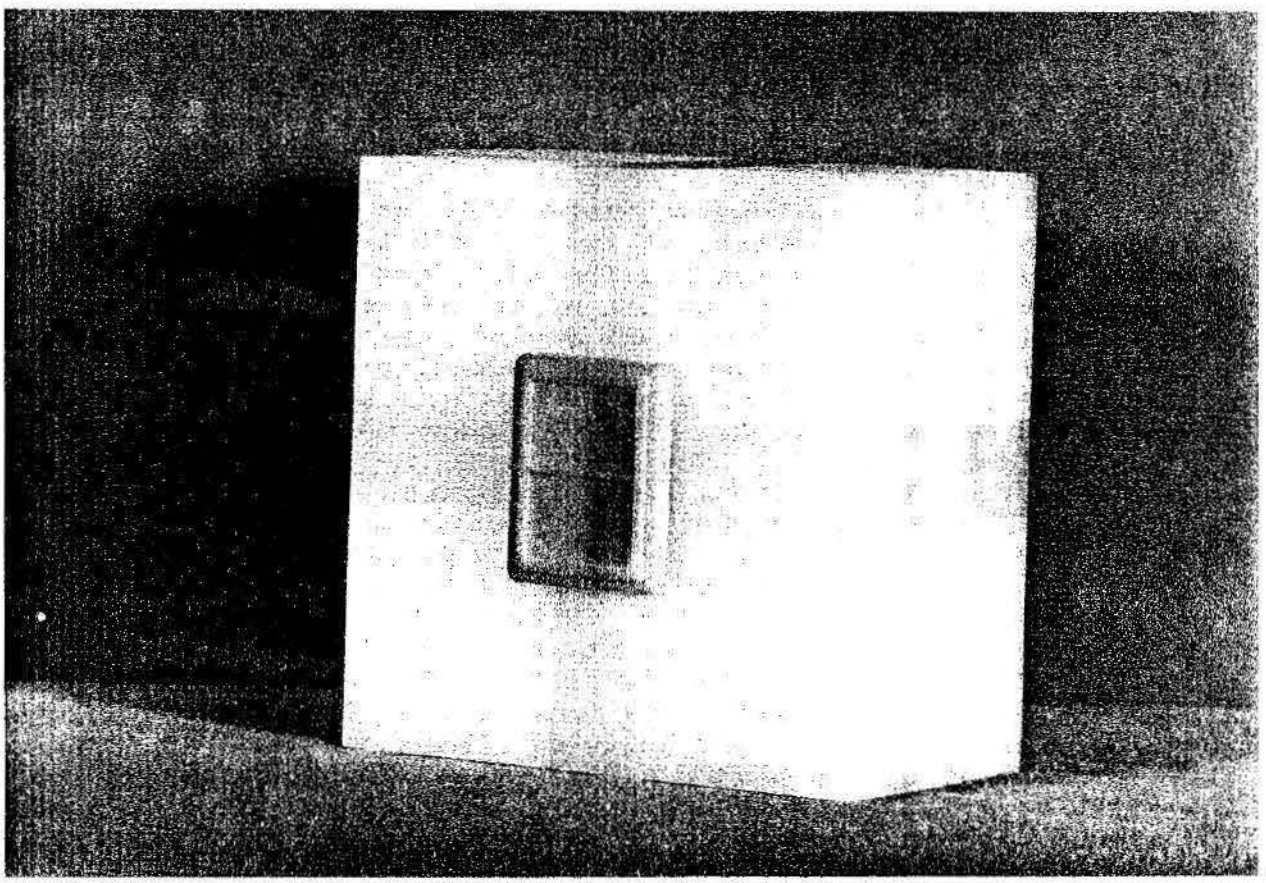


FIG. 6-6 Posted TLD Monitor. The yellow holder with cards enclosed is mounted on a 6"x6"x3" phantom

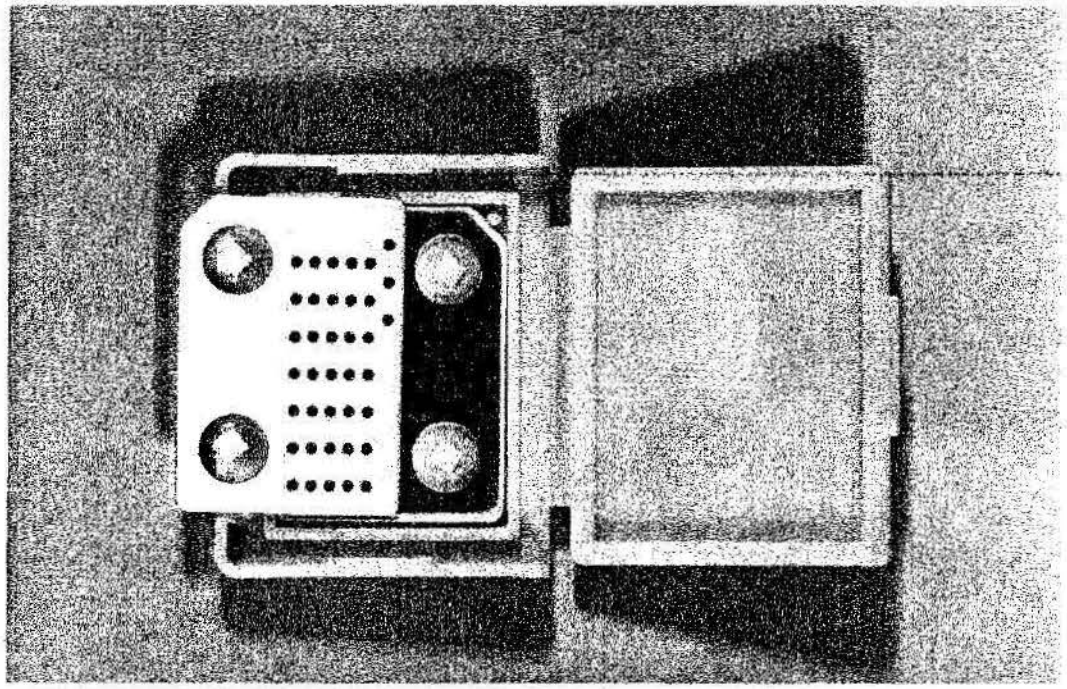


FIG. 6-7 Loading LiF TLD cards in holder for Posted TLD Monitor.

(2) Lif TLD Area Monitor. This monitor, figure 6-8, consists of a polyethylene cylinder which is essentially the same size and internal design as the AN/PDR-70, except that the monitor has a drawer to hold two LiF TLD cards, and is encased in an aluminum box for mounting and protection. The area monitor should be mounted, either by bolting or gluing, so that one of the four larger surfaces faces the neutron source and the drawer is in a horizontal plane.

The drawer is manually removed when unlocked and two LiF TLD cards are inserted so the notched corners of the cards align with the positioning guide in the drawer. When correctly inserted, one card will have the aluminum side up, and the other the black side up with the six digit serial number visible. After positioning the cards, slowly slide the drawer into the phantom, close and lock. The serial numbers of the two cards must be recorded in column 5 and 6 on the NAVMED 6470/3 with serial number of the card with the aluminum side up entered in column 5 and the serial number of the card with the black side up entered in column 6.

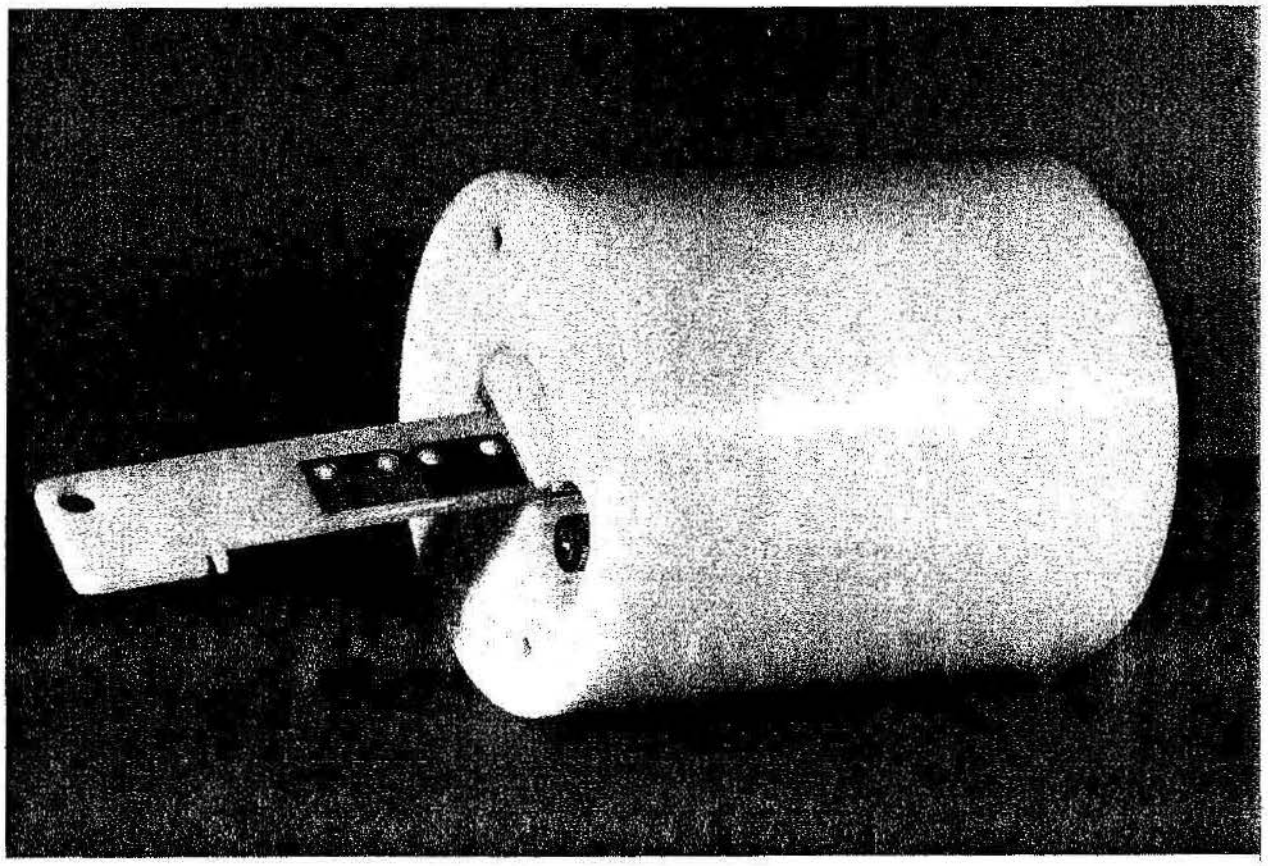


FIG. 6.8 LiF TLD Area Monitor. Aluminum mounting encasement not shown.

(10) Extremity Monitoring. A limited number of personnel, particularly those in Nuclear Medicine, Radiation Therapy and some industrial applications, handle large quantities of radioactive substances in the routine functions of their job. To assure that appropriate radiation protection practices are followed and to evaluate exposure to extremities, the BUMED Dosimetry Center provides and evaluates LiF TLD chips worn by these individuals. This service may be obtained upon request to Chief, Bureau of Medicine and Surgery, Code 3C2, stating the requirement, number of personnel to be monitored, location of the monitor on the individual, radioactive material being handled and other pertinent information. The chips are evaluated for exposure to photons only and shall not be used for evaluation of alpha, beta or neutron exposure. Complete instructions for handling and use of the LiF TLD chips are provided to the end user upon BUMED approval of program implementation.

(11) Report Form. Each submission of LiF TLD for evaluation shall be accompanied by the original Thermoluminescent Dosimetry Evaluation Form (NAVMED 6470/3) completed in accordance with

the instructions on the reverse side of the form. When evaluated, the original will be completed by the Dosimetry Center and returned to the submitting activity. Submission of unused devices should be accompanied by a memorandum indicating such. A copy of the NAVMED 6470/3 is contained in Appendix A.

6-7 DOSIMETRY FOR DIVERS

Divers working in areas where exposure to neutron radiation exposure is likely shall be monitored with a LiF TLD. To prevent seawater contamination of the aluminum card, enclose the LiF TLD (yellow holder with card) in two self sealing polyethlene bags and check for seawater contamination after diving operations. If salt water is detected in the inner bag, rinse the LiF TLD card with fresh water and hand dry. The LiF TLD device must be worn against the body with the belt loop toward the body. It should not be worn on exterior straps or gear.

APPENDIX A - SAMPLE FORMS

DD 1141	Record of Occupational Exposure to Ionizing Radiation
NAVMED 6470/1	Exposure to Ionizing Radiation, Report Symbol 6470-1 or 6470-2
STANDARD FORM 88	Report of Medical Examination
STANDARD FORM 93	Report of Medical History
STANDARD FORM 513	Consultation Sheet with Slit Lamp Overprint
NAVMED 6470/3	Thermoluminescent Dosimetry Evaluation

Standard Form 88
(Rev. June 1956)
Bureau of the Budget
Circular A-32 (Rev.)

REPORT OF MEDICAL EXAMINATION

88-105

1. LAST NAME—FIRST NAME—MIDDLE NAME			2. GRADE AND COMPONENT OR POSITION	3. IDENTIFICATION NO.
4. HOME ADDRESS (*Number, street or RFD, city or town, zone and State*)			5. PURPOSE OF EXAMINATION Occupational Exposure to Ionizing Rad ( )	6. DATE OF EXAMINATION
7. SEX	8. RACE	9. TOTAL YEARS GOVERNMENT SERVICE MILITARY / CIVILIAN	10. AGENCY	11. ORGANIZATION UNIT UIC:
12. DATE OF BIRTH	13. PLACE OF BIRTH		14. NAME, RELATIONSHIP, AND ADDRESS OF NEXT OF KIN	
15. EXAMINING FACILITY OR EXAMINER, AND ADDRESS			16. OTHER INFORMATION	
17. RATING OR SPECIALTY			TIME IN THIS CAPACITY (*Total*)	LAST SIX MONTHS

CLINICAL EVALUATION

NORMAL	(*Check each item in appropriate column, enter "NE" if not evaluated.*)	ABNORMAL
	18. HEAD, FACE, NECK AND SCALP	
	19. NOSE	
	20. SINUSES	
	21. MOUTH AND THROAT	
	22. EARS—GENERAL (*Ext. & ext. canals*) (*Auditory acuity under items 70 and 71*)	
	23. DRUMS (*Perforation*)	
	24. EYES—GENERAL (*Visual acuity and refraction under items 58, 60 and 61*)	
	25. OPHTHALMOSCOPIC	
	26. PUPILS (*Equality and reaction*)	
	27. OCULAR MOTILITY (*Associated parallel movements, nystagmus*)	
	28. LUNGS AND CHEST (*Include breasts*)	
	29. HEART (*Thrust, size, rhythm, sounds*)	
	30. VASCULAR SYSTEM (*Varicosities, etc.*)	
	31. ABDOMEN AND VISCERA (*Include hernia*)	
	32. ANUS AND RECTUM (*Hemorrhoids, fistulae*) (*Prostate, if indicated*)	
	33. ENDOCRINE SYSTEM	
	34. G-U SYSTEM	
	35. UPPER EXTREMITIES (*Strength, range of motion*)	
	36. FEET	
	37. LOWER EXTREMITIES (*Except feet*) (*Strength, range of motion*)	
	38. SPINE, OTHER MUSCULOSKELETAL	
	39. IDENTIFYING BODY MARKS, SCARS, TATTOOS	
	40. SKIN, LYMPHATICS	
	41. NEUROLOGIC (*Equilibrium tests under item 78*)	
	42. PSYCHIATRIC (*Specify any personality deviation*)	
	43. PELVIC (*Females only*) (*Check how done*) ☐ VAGINAL ☐ RECTAL	

NOTES. (*Describe every abnormality in detail. Enter pertinent item number before each comment. Continue in item 73 and use additional sheets if necessary.*)

(*Continue in item 73*)

44. DENTAL (*Place appropriate symbols above or below number of upper and lower teeth, respectively.*)

O—*Restorable teeth*
/—*Nonrestorable teeth*
X—*Missing teeth*
XXX—*Replaced by dentures*
(8 X 8)—*Fixed bridge, brackets to include abutments*

RIGHT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	LEFT
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	

REMARKS AND ADDITIONAL DENTAL DEFECTS AND DISEASES

LABORATORY FINDINGS

45. URINALYSIS: A. SPECIFIC GRAVITY		46. CHEST X-RAY (*Place, date, film number and result*)
B. ALBUMIN	D. MICROSCOPIC	
C. SUGAR		
47. SEROLOGY (*Specify test used and result*)	48. EKG	49. BLOOD TYPE AND RH FACTOR

50. OTHER TESTS Complete blood count: HCT___; HGB(optional)___; WBC___; N___; L___; M___; E___; B___; BF___.

MEASUREMENTS AND OTHER FINDINGS

51. HEIGHT	52. WEIGHT	53. COLOR HAIR	54. COLOR EYES	55. BUILD: ☐ SLENDER ☐ MEDIUM ☐ HEAVY ☐ OBESE	56. TEMPERATURE

57. BLOOD PRESSURE (*Arm at heart level*)						58. PULSE (*Arm at heart level*)				
A. SITTING	SYS. / DIAS.	B. RECUMBENT	SYS. / DIAS.	C. STANDING (3 min.)	SYS. / DIAS.	A. SITTING	B. AFTER EXERCISE	C. 2 MIN. AFTER	D. RECUMBENT	E. AFTER STANDING 3 MIN.

59. DISTANT VISION		60. REFRACTION			61. NEAR VISION	
RIGHT 20/	CORR. TO 20/	BY	S.	CX	CORR. TO	BY
LEFT 20/	CORR. TO 20/	BY	S.	CX	CORR. TO	BY

62. HETEROPHORIA (*Specify distance*)

ES°	EX°	R. H.	L. H.	PRISM DIV.	PRISM CONV. CT	PC	PD

63. ACCOMMODATION		64. COLOR VISION (*Test used and result*)	65. DEPTH PERCEPTION (*Test used and score*)	UNCORRECTED
RIGHT	LEFT			CORRECTED
66. FIELD OF VISION		67. NIGHT VISION (*Test used and score*)	68. RED LENS TEST	69. INTRAOCULAR TENSION

70. HEARING			71. AUDIOMETER								72. PSYCHOLOGICAL AND PSYCHOMOTOR (*Tests used and score*)
RIGHT WV	/15 SV	/15		250 *260*	500 *510*	1000 *1084*	2000 *2048*	3000 *3108*	4000 *4096*	6000 *6144*	8000 *8192*	
LEFT WV	/15 SV	/15	RIGHT									
			LEFT									

73. NOTES (*Continued*) AND SIGNIFICANT OR INTERVAL HISTORY

(*Use additional sheets if necessary*)

74. SUMMARY OF DEFECTS AND DIAGNOSES (*List diagnoses with item numbers*)

75. RECOMMENDATIONS—FURTHER SPECIALIST EXAMINATIONS INDICATED (*Specify*)

76. A. PHYSICAL PROFILE

P	U	L	H	E	S

77. EXAMINEE (*Check*)

A. ☐ IS QUALIFIED FOR Occupational Exposure to Ionizing Radiation and to perform all duties of his/her rank/rate at sea and in the field.

B. ☐ IS NOT QUALIFIED FOR

B. PHYSICAL CATEGORY

78. IF NOT QUALIFIED, LIST DISQUALIFYING DEFECTS BY ITEM NUMBER

A	B	C	E

79. TYPED OR PRINTED NAME OF PHYSICIAN	SIGNATURE	
80. TYPED OR PRINTED NAME OF PHYSICIAN	SIGNATURE	
81. TYPED OR PRINTED NAME OF DENTIST OR PHYSICIAN (*Indicate which*)	SIGNATURE	
82. TYPED OR PRINTED NAME OF REVIEWING OFFICER OR APPROVING AUTHORITY	SIGNATURE	NUMBER OF ATTACHED SHEETS

STANDARD FORM 93
REV. OCTOBER 1974
GSA FPMR 101-11.8

APPROVED
OFFICE OF MANAGEMENT AND BUDGET No. 29-R0191

REPORT OF MEDICAL HISTORY

(THIS INFORMATION IS FOR OFFICIAL AND MEDICALLY-CONFIDENTIAL USE ONLY AND WILL NOT BE RELEASED TO UNAUTHORIZED PERSONS)

1. LAST NAME—FIRST NAME—MIDDLE NAME		2. SOCIAL SECURITY OR IDENTIFICATION NO.
3. HOME ADDRESS *(No. street or RFD, city or town, State, and ZIP CODE)*		4. POSITION *(title, grade, component)*
5. PURPOSE OF EXAMINATION Occupational Exposure to Ionizing Radiation ( )	6. DATE OF EXAMINATION	7. EXAMINING FACILITY OR EXAMINER, AND ADDRESS *(Include ZIP Code)*

8. STATEMENT OF EXAMINEE'S PRESENT HEALTH AND MEDICATIONS CURRENTLY USED *(Follow by description of past history, if complaint exists)*

9. HAVE YOU EVER *(Please check each item)*

YES	NO	*(Check each item)*
		Lived with anyone who had tuberculosis
		Coughed up blood
		Bled excessively after injury or tooth extraction
		Attempted suicide
		Been a sleepwalker

10. DO YOU *(Please check each item)*

YES	NO	*(Check each item)*
		Wear glasses or contact lenses
		Have vision in both eyes
		Wear a hearing aid
		Stutter or stammer habitually
		Wear a brace or back support

11. HAVE YOU EVER HAD OR HAVE YOU NOW *(Please check at left of each item)*

YES	NO	DON'T KNOW	*(Check each item)*
			Scarlet fever, erysipelas
			Rheumatic fever
			Swollen or painful joints
			Frequent or severe headache
			Dizziness or fainting spells
			Eye trouble
			Ear, nose, or throat trouble
			Hearing loss
			Chronic or frequent colds
			Severe tooth or gum trouble
			Sinusitis
			Hay Fever
			Head injury
			Skin diseases
			Thyroid trouble
			Tuberculosis
			Asthma
			Shortness of breath
			Pain or pressure in chest
			Chronic cough
			Palpitation or pounding heart
			Heart trouble
			High or low blood pressure

YES	NO	DON'T KNOW	*(Check each item)*
			Cramps in your legs
			Frequent indigestion
			Stomach, liver, or intestinal trouble
			Gall bladder trouble or gallstones
			Jaundice or hepatitis
			Adverse reaction to serum, drug, or medicine
			Broken bones
			Tumor, growth, cyst, cancer
			Rupture/hernia
			Piles or rectal disease
			Frequent or painful urination
			Bed wetting since age 12
			Kidney stone or blood in urine
			Sugar or albumin in urine
			VD—Syphilis, gonorrhea, etc.
			Recent gain or loss of weight
			Arthritis, Rheumatism, or Bursitis
			Bone, joint or other deformity
			Lameness
			Loss of finger or toe
			Painful or "trick" shoulder or elbow
			Recurrent back pain

YES	NO	DON'T KNOW	*(Check each item)*
			"Trick" or locked knee
			Foot trouble
			Neuritis
			Paralysis (include infantile)
			Epilepsy or fits
			Car, train, sea or air sickness
			Frequent trouble sleeping
			Depression or excessive worry
			Loss of memory or amnesia
			Nervous trouble of any sort
			Periods of unconsciousness
			Occupational Exp to Ion Rad
			Therapeutic Exp to Ion Rad or Radiopharmaceuticals
			Worked with unsealed Radium
			Anemia
			Cancer or precancerous lesions
			Cataracts
			Family history of: cancer, anemia, cataracts

12. FEMALES ONLY: HAVE YOU EVER

			Been treated for a female disorder
			Had a change in menstrual pattern

13. WHAT IS YOUR USUAL OCCUPATION?

14. ARE YOU *(Check one)*
☐ Right handed ☐ Left handed

93-102

YES	NO	CHECK EACH ITEM YES OR NO. EVERY ITEM CHECKED YES MUST BE FULLY EXPLAINED IN BLANK SPACE ON RIGHT
		15. Have you been refused employment or been unable to hold a job or stay in school because of: A. Sensitivity to chemicals, dust, sunlight, etc.
		B. Inability to perform certain motions.
		C. Inability to assume certain positions.
		D. Other medical reasons (*If yes, give reasons.*)
		16. Have you ever been treated for a mental condition? (*If yes, specify when, where, and give details.*)
		17. Have you ever been denied life insurance? (*If yes, state reason and give details.*)
		18. Have you had, or have you been advised to have, any operations? (*If yes, describe and give age at which occurred.*)
		19. Have you ever been a patient in any type of hospitals? (*If yes, specify when, where, why, and name of doctor and complete address of hospital.*)
		20. Have you ever had any illness or injury other than those already noted? (*If yes, specify when, where, and give details.*)
		21. Have you consulted or been treated by clinics, physicians, healers, or other practitioners within the past 5 years for other than minor illnesses? (*If yes, give complete address of doctor, hospital, clinic, and details.*)
		22. Have you ever been rejected for military service because of physical, mental, or other reasons? (*If yes, give date and reason for rejection.*)
		23. Have you ever been discharged from military service because of physical, mental, or other reasons? (*If yes, give date, reason, and type of discharge: whether honorable, other than honorable, for unfitness or unsuitability.*)
		24. Have you ever received, is there pending, or have you applied for pension or compensation for existing disability? (*If yes, specify what kind, granted by whom, and what amount, when, why.*)

I certify that I have reviewed the foregoing information supplied by me and that it is true and complete to the best of my knowledge.
I authorize any of the doctors, hospitals, or clinics mentioned above to furnish the Government a complete transcript of my medical record for purposes of processing my application for this employment or service.

TYPED OR PRINTED NAME OF EXAMINEE	SIGNATURE

NOTE: HAND TO THE DOCTOR OR NURSE, OR IF MAILED MARK ENVELOPE "TO BE OPENED BY MEDICAL OFFICER ONLY."

25. Physician's summary and elaboration of all pertinent data (*Physician shall comment on all positive answers in items 9 through 24. Physician may develop by interview any additional medical history he deems important, and record any significant findings here.*)

TYPED OR PRINTED NAME OF PHYSICIAN OR EXAMINER	DATE	SIGNATURE	NUMBER OF ATTACHED SHEETS

REVERSE OF STANDARD FORM 93

☆ GPO : 1977 O - 261-647 (32611)

MEDICAL RECORD	CONSULTATION SHEET

REQUEST

TO:	FROM: *(Requesting physician or activity)*	DATE OF REQUEST

REASON FOR REQUEST *(Complaints and findings)*

Slit lamp examination for occupational exposure to ionizing radiation

Age_____

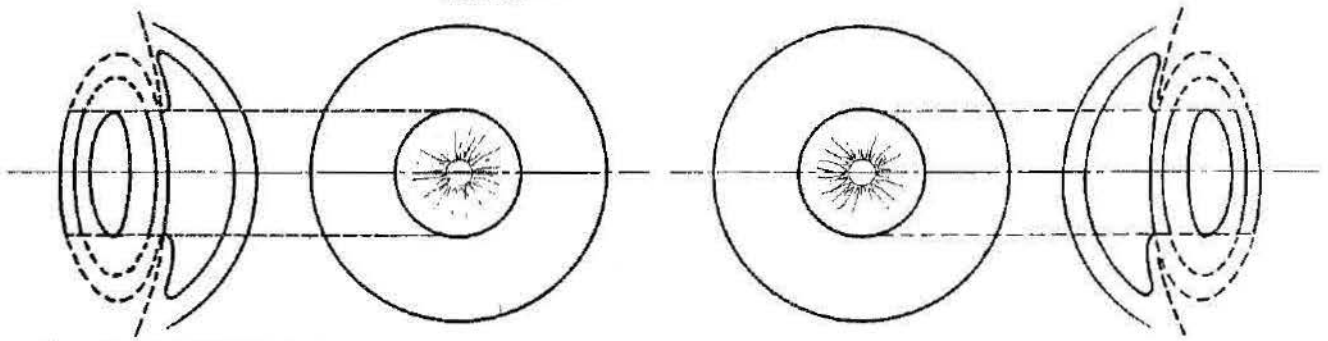
PROVISIONAL DIAGNOSIS

DOCTOR'S SIGNATURE	APPROVED	PLACE OF CONSULTATION	☐ ROUTINE ☐ TODAY
		☐ BEDSIDE ☐ ON CALL	☐ 72 HOURS ☐ EMERGENCY

CONSULTATION REPORT

1. VISION: DISTANT OD: 20/___ corr. by R_x to 20/___ NEAR OD: 20/___ corr. by R_x to 20/___
   OS: 20/___ corr. by R_x to 20/___ OS: 20/___ corr. by R_x to 20/___

2. INTRAOCULAR TENSION: OD:____mmHg METHOD:_____
   OS:____mmHg



3. SLIT LAMP DILATED WITH_____
   (Diagram all positive findings & normal variants)

4. DIAGNOSIS

5. REMARKS

(Continued on reverse side)

SIGNATURE AND TITLE			DATE
IDENTIFICATION NO.	ORGANIZATION	REGISTER NO.	WARD NO.

PATIENT'S IDENTIFICATION *(For typed or written entries give: Name—last, first, middle; grade; rank; race; hospital or medical facility)*

*GPO 1978: 251-278

CONSULTATION SHEET
STANDARD FORM 513 (Rev. 9-77)
Prescribed by GSA/ICMR
FPMR 101-11.806-6
513-107

THERMOLUMINESCENT DOSIMETRY EVALUATION
NAVMED 6470/3 (Rev. 11-80)

INSTRUCTIONS:
1. SEE REVERSE SIDE BEFORE COMPLETING THIS FORM
2. SUBMIT ORIGINAL OF THIS FORM WITH EACH SUBMISSION OF TLD's TO THE BUMED DOSIMETRY CENTER, NATIONAL NAVAL MEDICAL CENTER, BETHESDA, MD 20014

2. FACILITY CODE

3. DATE SUBMITTED

1. ACTIVITY SUBMITTING REPORT *(Name and Address)*

4. NAME *(Last and Initials)*	5. SOCIAL SECURITY ACCOUNT NUMBER	6. TLD NUMBER	7. PERIOD OF EXPOSURE						8. RADIATION TYPE	DOSE EVALUATION IN REM				
			ISSUED			COLLECTED				9. X-RAY	10. GAMMA	11. NEUTRON	12. TOTAL	13. EXTREMITIES
			YR	MO	DA	YR	MO	DA						

14. REMARKS

A-13

AGN-4

15. SUBMITTED BY	16. DATE RECEIVED	17. DATE RELEASED	18. APPROVED BY	Page ___ of ___

INSTRUCTIONS

The following instructions are applicable to the numbered items on the other side of the form.

1. List complete name and mailing address of submitting activity, including zip code.

2. List six digit Facility Code as described in Chapter 5, NAVMED P-5055.

3. Record date on which the report is submitted.

4. List last name and initials of personnel to whom the dosimeter was issued. CONTROL TLD's shall be listed before the personnel dosimeters. Use the terms POSTED TLD for dosimeters posted on the polyethylene block and AREA MONITOR for those inserted in the polyethylene cylinder. POSTED and AREA dosimeters are to be listed after the personnel dosimeters.

5. List social security number for all personnel to whom dosimeters were issued. List the serial number of card one placed in the Posted or Area monitor.

6. List the six digit serial number as it appears on the TLD card. List the serial number of card two placed in the Posted or Area monitor.

NOTE: Organize TLD's in the same order as listed when submitting for evaluation.

7. List dates of issue and collection for each dosimeter.

8. Use one of the following numerical codes to indicate the type(s) of radiation exposure to be evaluated for each dosimeter:

1. X-ray 2. Gamma 3. Neutron 4. Gamma and Neutron
5. Extremities – x-ray 6. Extremities – gamma

9. through 13. Leave Blank

14. Use as appropriate by submitting or processing activity.

15. Legible signature and title of person submitting report.

16, 17 and 18. Leave blank. For use by processing facility.

THERMOLUMINESCENT DOSIMETRY AUDIT PROCEDURES

1. Identification:

a. Conduct a random check of a few (4 to 8) personnel to determine if they are, in fact, wearing the dosimeter that is recorded as having been issued to them.

b. Are dosimeters being worn properly?

c. Are dosimeters being issued to any unauthorized personnel?

d. Has the radiation physical examination, if required, of all personnel issued dosimeters been verified before the dosimeter was issued?

2. Issue and Collection:

a. Determine if the issue periods outlined in NAVSHIPS 389-0153 and NAVMED P-5055 for various categories of personnel, are being complied with.

b. Is monthly and quarterly exposure data from the DT-526/PD being forwarded to the Medical Department within five working days?

c. Have all personnel issued a dosimeter for administrative purposes been trained in accordance with article 208 of NAVSHIPS 389-0153 and has this training been documented?

d. Have all records pertaining to dosimeters been retained in accordance with NAVSHIPS 389-0153 and NAVMED P-5055?

3. Evaluation Technique (DT-526/PD only):

a. Are procedures outlined in NAVELEX 0967-456-6010 for calibration and operation of the CP-1112/PD being adhered to? Have unauthorized alterations or procedures been substituted?

b. Are the required calibration checks on the CP-1112/PD being accomplished at proper intervals during reading of the DT-526/PD dosimeters?

c. Has calibration of the DT-526/PD, as required by NAVSHIPS 389-0153, Article 233.4, been performed?

d. Verify that DT-526/PD calibration exposures using the TS-1189 source have been properly made.

4. Compilation and Transcription of Dose (DT-526/PD only)

a. Select the five personnel with the highest cumulative doses for the month from amongst those who have had daily dosimeter readings and audit their reported exposures with an adding machine.

APPENDIX B

THERMOLUMINESCENT DOSIMETRY AUDIT PROCEDURES

Introduction

1. The transition, by forces afloat, from photodosimetry to thermoluminescent dosimetry for monitoring personnel exposure to ionizing radiation requires that the Medical Department Representative verify that the dose information is accurate. To accomplish this, the Medical Department Representative shall conduct an audit of the program in effect at his command once each quarter. Two of these quarterly audits are to be conducted in conjunction with the semi-annual radiation health program external audit required by NAVMED P-5055. The following audit procedures constitute a broad outline of procedural checks to be made. The list is not considered as restrictive and additional evaluations designed to promote and maintain a viable and effective monitoring program are encouraged.

b. Do exposures reported from the DT-526/PD dosimeter appear to be reasonable for the job performed by the man wearing the dosimeter? Previous exposure data reported for similar circumstances of work should provide a satisfactory guide for comparison.

c. Select several TLD record forms (figure 15A of NAVSHIPS 389-0153) at random and check for completeness.

d. Has the strip chart recorder been used for all readings?

e. Are the doses indicated on the TLD reader digital display being accurately recorded on worksheets?

5. Visitors:

a. Are current requirements for issuance of a visitor's dosimeter being complied with?

6. Lost/Damaged Dosimeters:

a. Have any dosimeters been lost or damaged during the preceding reporting period?

b. Are the requirements for estimation of dose in the case of lost or damaged dosimeters, as outlined in NAVMED P-5055, being complied with?